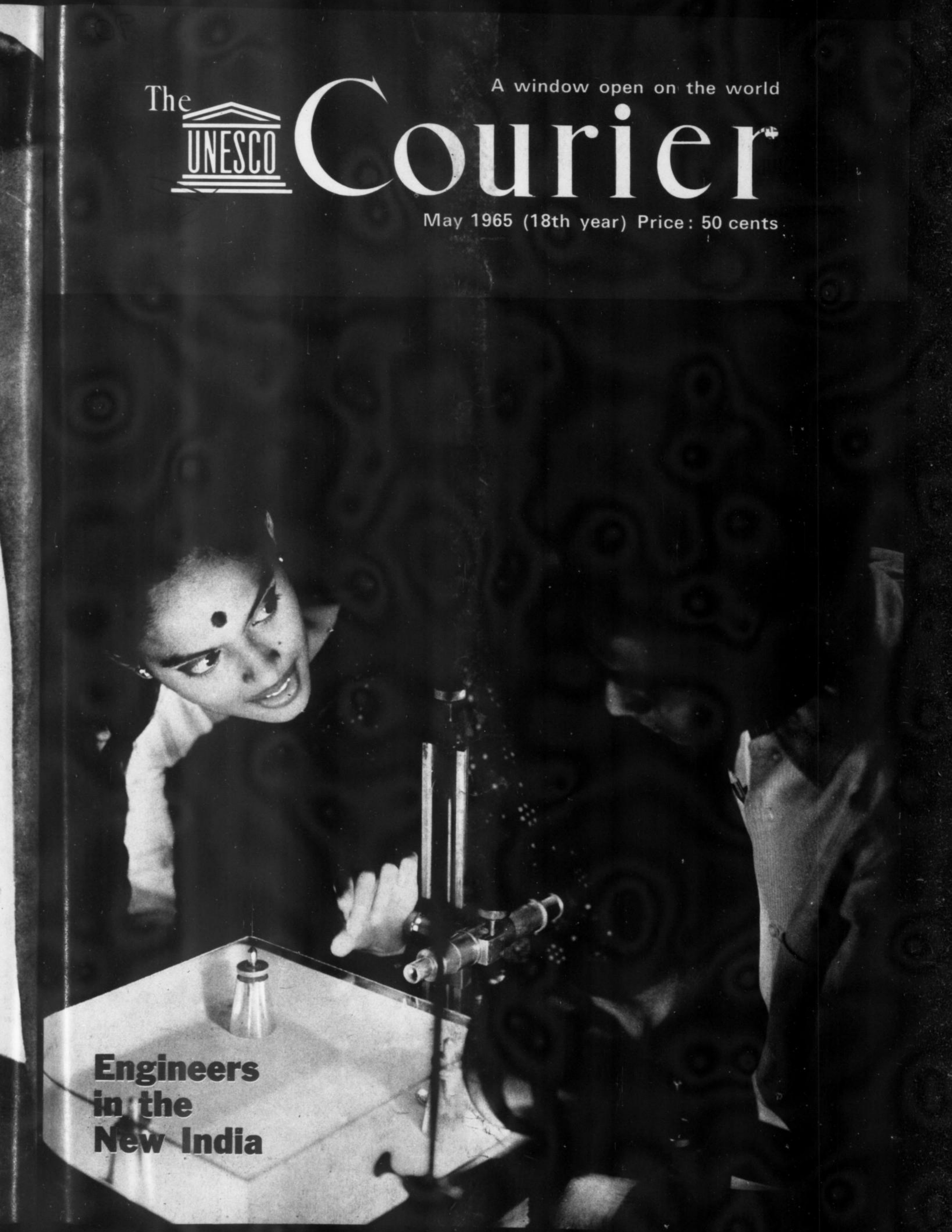
A window open on the world

The UNESCO Courier

May 1965 (18th year) Price: 50 cents



Engineers in the New India

Man in noiselessness

Standing on a metal screen in a huge acoustical chamber, but seeming to be suspended in mid-air, a researcher listens to sounds " manipulated " by delicate instruments, then reports what he hears. Thick fibreglass wedges on walls make room soundproof and eliminate echoes. In such specialized laboratories scientists are designing improved equipment for the vast and still expanding network of world communications. See page 4 for the story of the International Telecommunications Union, now celebrating its foundation one hundred years ago.

USIS

The UNESCO Courier

A WINDOW OPEN ON THE WORLD

MAY 1965 - 18TH YEAR

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1965 INTERNATIONAL CO-OPERATION YEAR

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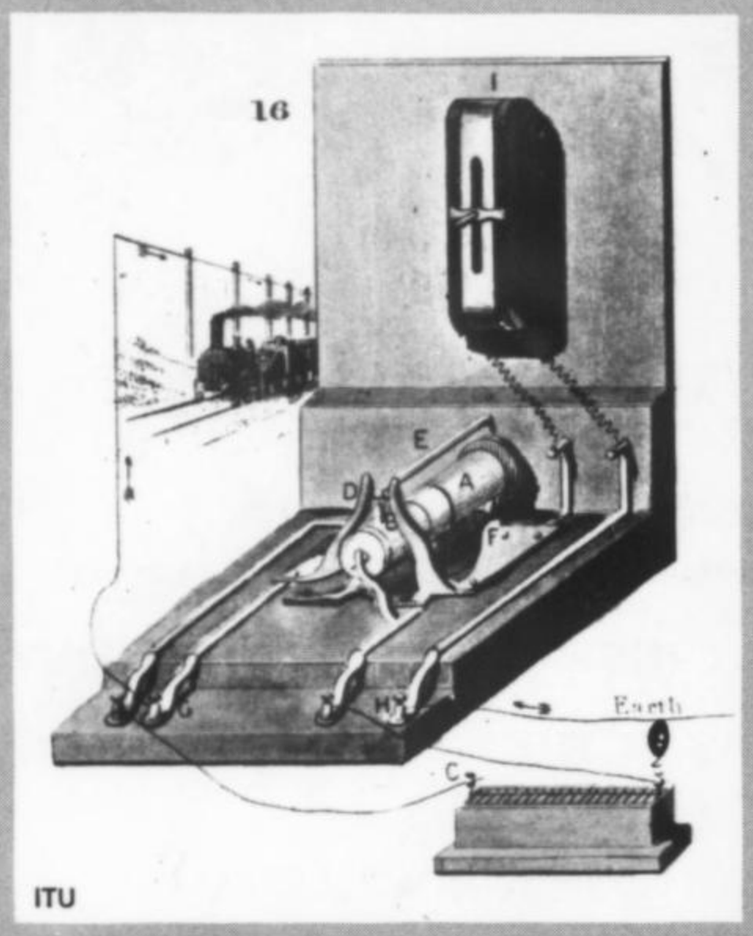
Cover photo

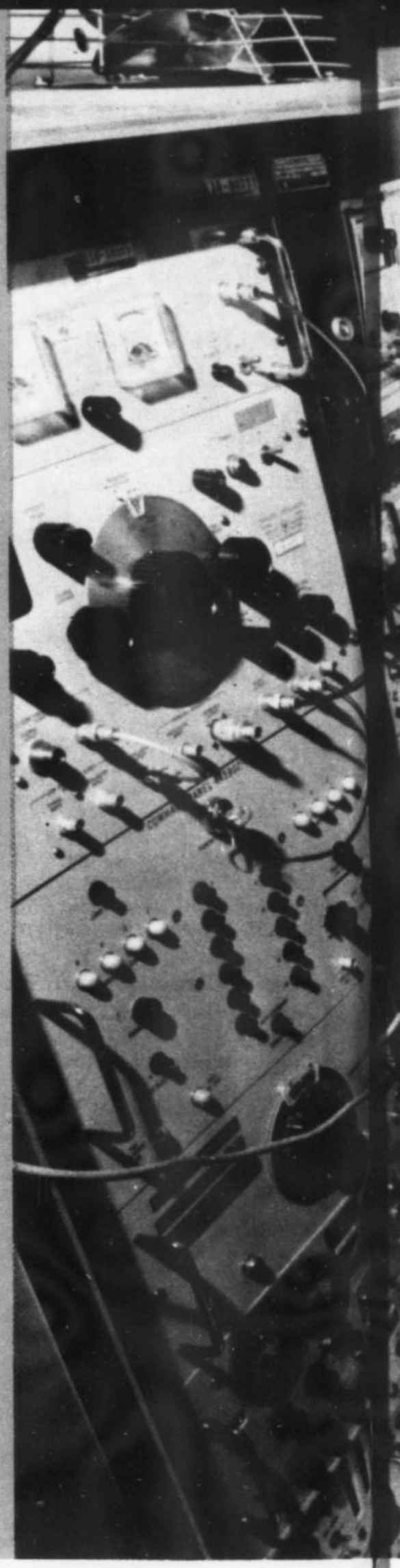
To train the engineers needed by its fast-developing industries, India has set up a network of regional technological institutes. Here, at the Institute of Technology in Bombay, created with U.N. technical assistance through Unesco, a student's experiment in the physics laboratory is supervised by a young woman assistant instructor — symbol of the new India of the engineer (see article page 14).

© Paul Almasy, Paris



ITU

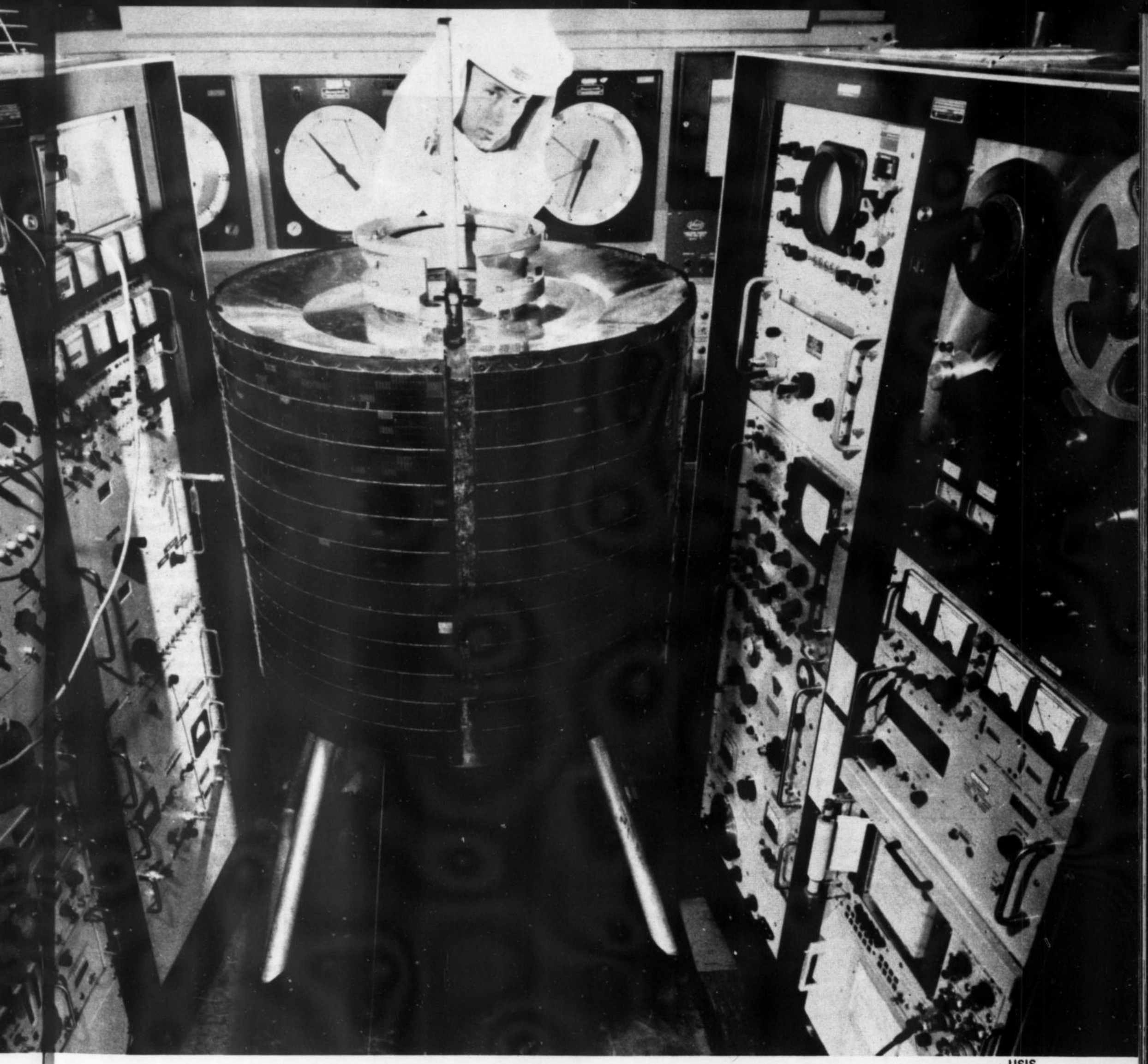
With the launching of the communications satellite, "Early Bird" (right) from Cape Kennedy, U.S.A., on April 6, the world now has a "telephone exchange" in outer space. The new satellite will also be used for transmitting telegraph messages and TV pictures above the Atlantic. Capable of transmitting simultaneously 240 two-way telephone conversations, "Early Bird" has now to be tried out experimentally for two months. "Early Bird" is on an equatorial orbit at a height of 22,300 miles and keeps pace with the earth's rotation, thus appearing to hover at the same spot. The telecommunications revolution began a little over a century ago with the electric telegraph. To the world of the 1840s, the telegraph with its lines alongside the railway track (left) also seemed an astounding invention at the time.



1865-1965 TELE-COMMUNICATIONS

A century of international co-operation

The International Telecommunications Union (ITU), oldest of the United Nations specialized agencies, is celebrating its 100th birthday in 1965, designated by the United Nations as International Co-operation Year. The ITU was born as the International Telegraph Union, on May 17, 1865, when the growing network of electric telegraph lines linking country to country had shown the need for international agreement on communication procedures and regulations. Thirty-five years later the first radio transmissions opened up another new era in telecommunication. Radio, broadcasting, television and other technological achievements during the past fifty years have all brought increasing responsibilities to the ITU. Today, as the ITU enters its second century, the contributions it is making to the development of space communications show that it is already planning for the needs of tomorrow's world.



USIS

It might seem surprising that the ITU already has a century of achievements in peaceful international co-operation to its credit. Nothing, surely, could be more modern than telecommunications, with telex and television, with radio helping us to reach out into space and the prospect of our telephone calls travelling along beams of light. And yet perhaps this juxtaposition of old and new is not so strange. For what after all is "telecommunication"?

Human societies, as they developed and began to master the concept of distance, worked out a number of ingenious ways for communicating over the vast areas which separated them. Mostly, messengers of one kind or another were used. But there were also methods involving direct sight and sound—drums in the jungle, beacons along the coast, smoke signals on the horizon. These methods, picturesque to-day, were strictly practical solutions devised by man's imagination for overcoming the obstacles that distance placed in the way of his basic need to communicate. They were the first real telecommunications.

From the early dawn of civilization until a little over 100 years ago man did not get much further than the written message, the drum, the beacon and the smoke signal in his efforts to communicate at long distance. One of the last devices was an "optical telegraph" or semaphore invented by Claude Chappe, a Frenchman, at the end of the 18th century. Signal towers with movable arms were set on hilltops a few kilometres apart. Messages spelt out by different positions of the arms were read by telescope from one tower to another and passed on. The system worked quite fast on clear days but was useless at night or in fog.

With the development of electricity in the first half of the 19th century, man's capacity for practical achievement was suddenly enlarged a hundredfold. Nowhere was this

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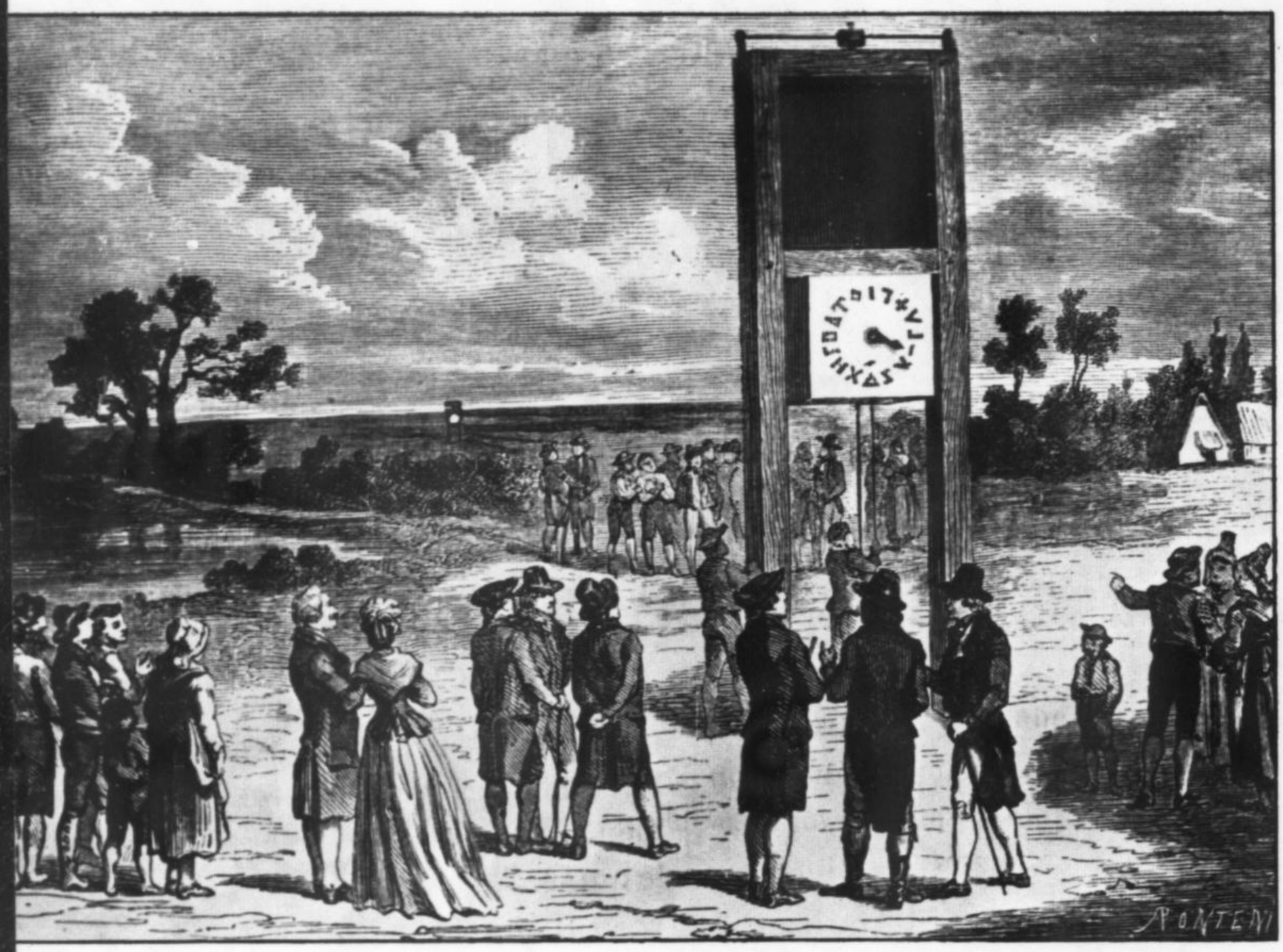
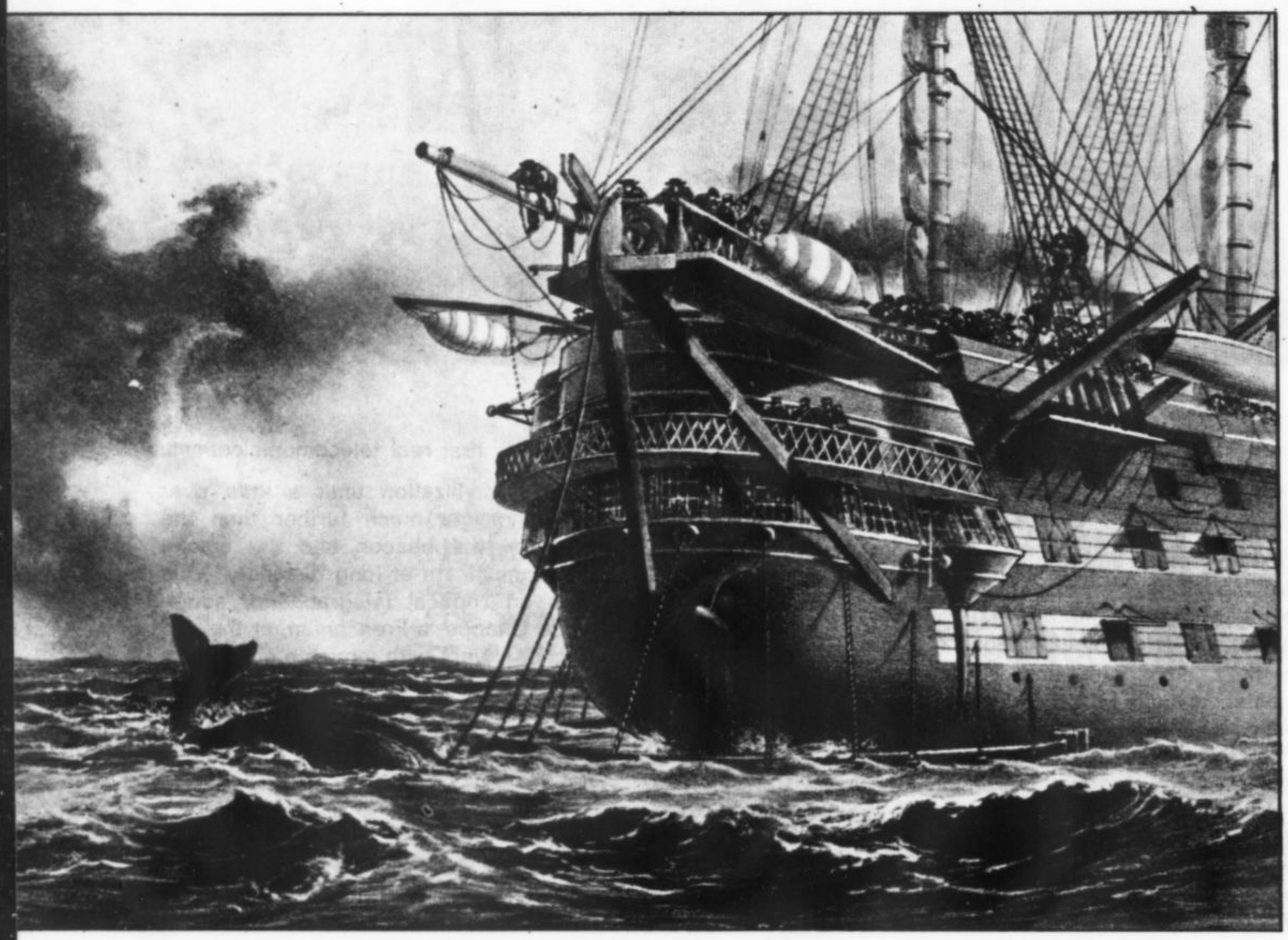


Left, in 1791, a French engineer, Claude Chappe, first demonstrates his visual telegraph system. Signal towers with movable arms were set on hilltops a few kilometres apart. Messages spelt out by different positions of the arms were read by telescope from one tower to another and passed on. When, in 1852, Chappe's system was finally superseded by the system of electrical telegraphy, France was covered by a network of 556 semaphore stations stretching over 3,000 miles (3,800 kms).



Laying the first trans-Atlantic cable. In July 1858 a British vessel, H.M.A. Agamemnon (shown here) and an American ship, the U.S.N.S. Niagara, linked cables in mid-Atlantic and set out for their respective home ports. Eight days later, on August 5, 1858, the first trans-Atlantic telegraph message was transmitted.

ITU photos

When telegraph networks halted at frontiers

seen more dramatically than in the invention of the electric telegraph, of which the first known line was operated in 1837 and the first public line opened by Samuel Morse in 1844. Its possibilities—for commerce, for the new railways, in diplomacy, in personal crises—aroused an immediate tide of enthusiasm which, by 1849, had carried the telegraph networks of European countries up to national frontiers. And that was the start of the problems which, sixteen years later, called into existence the ITU.

At first, for example, international telegrams had to be written down on a piece of paper and carried across the border by a messenger at each frontier they passed. Then there was the question of dividing the charges of the telegrams between the countries which carried them. These and other problems, for the most part totally new in international relations, finally led the Emperor Napoleon III in 1864 to invite the major countries of Europe to a conference to bring uniformity into the international telegraph system.

It was in May of 1865 that the delegates of twenty nations assembled in Paris. Among the states represented were Baden, Saxony, Württemberg and a single Norway-Sweden. The Turkish delegation had come part of the way on horseback. Great Britain had not been invited because its telegraph services, unlike those of other European nations, were still in private hands. Paris at the time was discussing Jules Verne's latest book, "De la Terre à la Lune" (From the Earth to the Moon) a subject of some practical importance to an ITU Conference 98 years later.

The Convention that was signed on May 17, 1865 created the International Telegraph Union and brought common rules to Europe's international telegraph system. Uniform tariff rates were agreed on (except, understandably, for the easternmost regions of the Russian and Turkish Empires) and the French gold franc was made the currency for the payment of international accounts.

THIS historic conference was followed in 1868 by one in Vienna which took a decision of almost equal importance for the history of international organizations. It set up a headquarters with a Secretariat. The headquarters, established in Berne as the Bureau of the Union, was under the control of the Swiss Government until 1947 and started of with a staff of three Swiss citizens. Modest though this beginning may have been, the principle was made clear for the future that international government organizations need a home and servants.

Throughout the rest of the 19th century the Union pushed purposefully ahead, holding a succession of larger and larger conferences in the romantically-tinted capitals of a now-forgotten Europe. It revised and redrafted the International Telegraph Regulations, sternly forbade telegrams against public order or decency, tirelessly wrestled with legal and financial problems, wondered whether the widespread use of private codes might not be imposing too great a strain on ordinary telegraphists. In 1885 it also took to legislating internationally for the telephone which had been launched by Alexander Graham Bell in 1876. It grew.

In 1895 and 1896, the first successful wireless transmissions, crowning decades of research and experiment, brought about what is still the greatest revolution in the history of telecommunications. The invention of radio, one of the proudest conquests that science can point to, will always be associated with such names as James Maxwell, Heinrich Hertz, Oliver Lodge, Alexander Popov, Guglielmo Marconi and Lee De Forest.

AT first regarded purely as a radically advanced form of telegraphy, radio spread across the international scene even more rapidly than the parent invention, for the first time bringing ships at sea within the reach of telecommunications. It became clear with equal rapidity that international regulations were needed.

One major problem was highlighted as early as 1902, when Prince Henry of Prussia, returning across the Atlantic from a visit to the United States, attempted to send a courtesy message to President Theodore Roosevelt, only to have it refused because the radio equipment on the ship was of different type and nationality from that at the shore station.

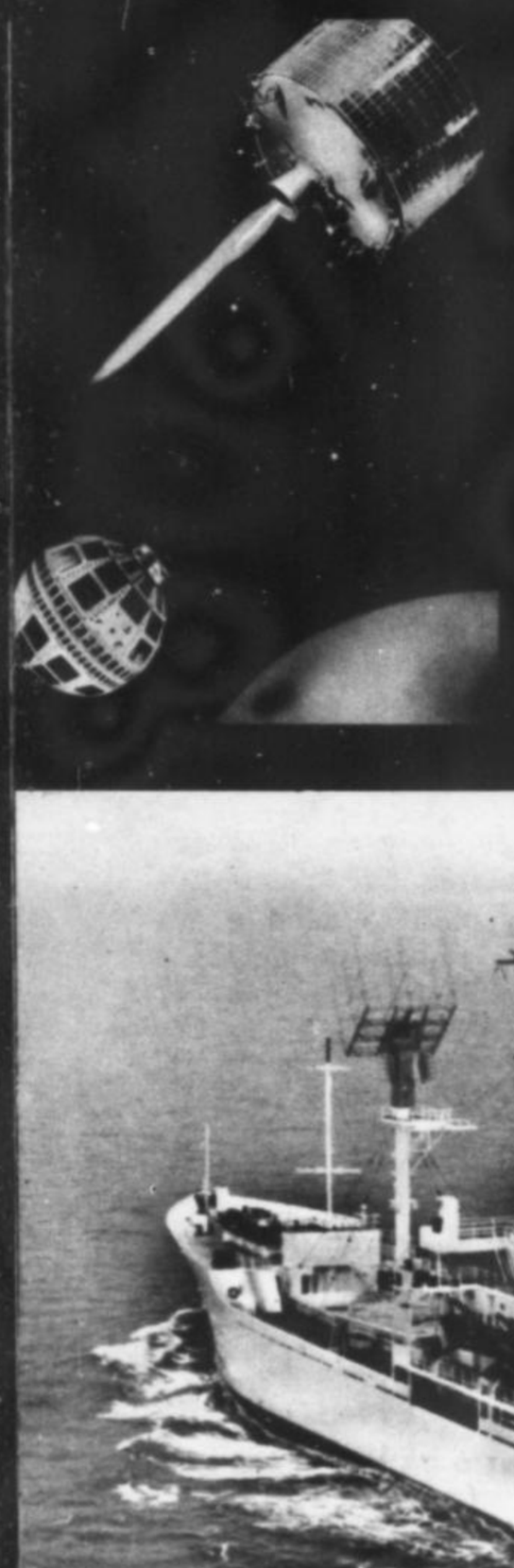
Partly as a result of this incident, the German Government called a preliminary radio conference in Berlin in 1903 which prepared the way for the Berlin Radio Conference of 1906. The 1906 Conference drew up the first International Radio Regulations, incorporating the principle that ship and coastal radio stations must accept messages from each other and adopting the SOS distress signal.

The problem of ensuring effective radio communications

CONT'D ON NEXT PAGE

The "heroic age" of radio broadcasting. In the early 1920's a radio service for the general public began to develop. This raised the problem of sharing out radio frequencies so as to avoid interference between stations—still one of the ITU's vital responsibilities.

CSF, Paris



A NEW ERA : SPACEVISION

New tools and new techniques have taken telecommunications into the space age. Experimental communication satellites placed in orbit around the earth have re-transmitted television programmes across the Atlantic and have opened a new era in long-distance communication. Left, artist's impression of two communication satellites, "Syncom" (top) and "Telstar". Below, first U.S. satellite communications ship. Huge cupola on upper deck is the Radome housing radar and other communications equipment. Right, tracking a spacecraft orbiting the earth. Spacecraft is pinpointed by bright light on map. It has just passed over Zanzibar on its 16th orbit. Tracking stations are shown on map and the circles around them indicate their range.

Photos USIS

TELECOMMUNICATIONS *(Cont'd)*

15 per cent of radio spectrum for outer space

at sea were far from solved, as was shown dramatically in 1912 when the desperate operator of the sinking "Titanic" was unable to communicate with a ship within rescue distance simply because *its* operator had gone off-duty for the night. But a start had nevertheless been made toward solving them.

The next decade saw great progress in the development of radio and then, in the early 1920's, a new kind of radio service began—broadcasting. All this gave rise to a new problem—how to share out the radio frequencies over which transmissions travel so as to avoid the otherwise inevitable interference between stations.

Since the use of radio constantly grows, it is a problem which has to go on being solved all the time, and now to-day, four decades and many conferences later, the international responsibility for radio frequencies remains one of the Union's heaviest and most vital jobs. The first move was made at the Washington Radio Conference of 1927 which proceeded by allocating bands of frequencies to all of the different radio services including maritime and broadcasting.

In 1932, at Madrid, the organization took the formal step of changing its name to the International Telecommunication Union, thereby embracing in its title the full range of its new responsibilities. And indeed radio was bringing in a new communication age. The 1930's saw the development of both television and radar. In the 1940's the speed of the technological advance became more rapid. Wartime broadcasting also made the world vividly aware that frequencies are free of frontiers. It was not hard to see that much wider international agreement on radio would be needed in the future.

Thus, two ITU Conferences met in Atlantic City in 1947 with the aims of magnifying and modernizing the Union. Under an agreement with the United Nations, the ITU

became a specialized agency and its headquarters were transferred from Berne to the traditionally international atmosphere of Geneva.

As a result of decisions taken at Atlantic City, ITU headquarters now harbour the staff of its four permanent organs —the General Secretariat, the International Frequency Registration Board and two International Consultative Committees (for radio and for telegraphy and telephony).

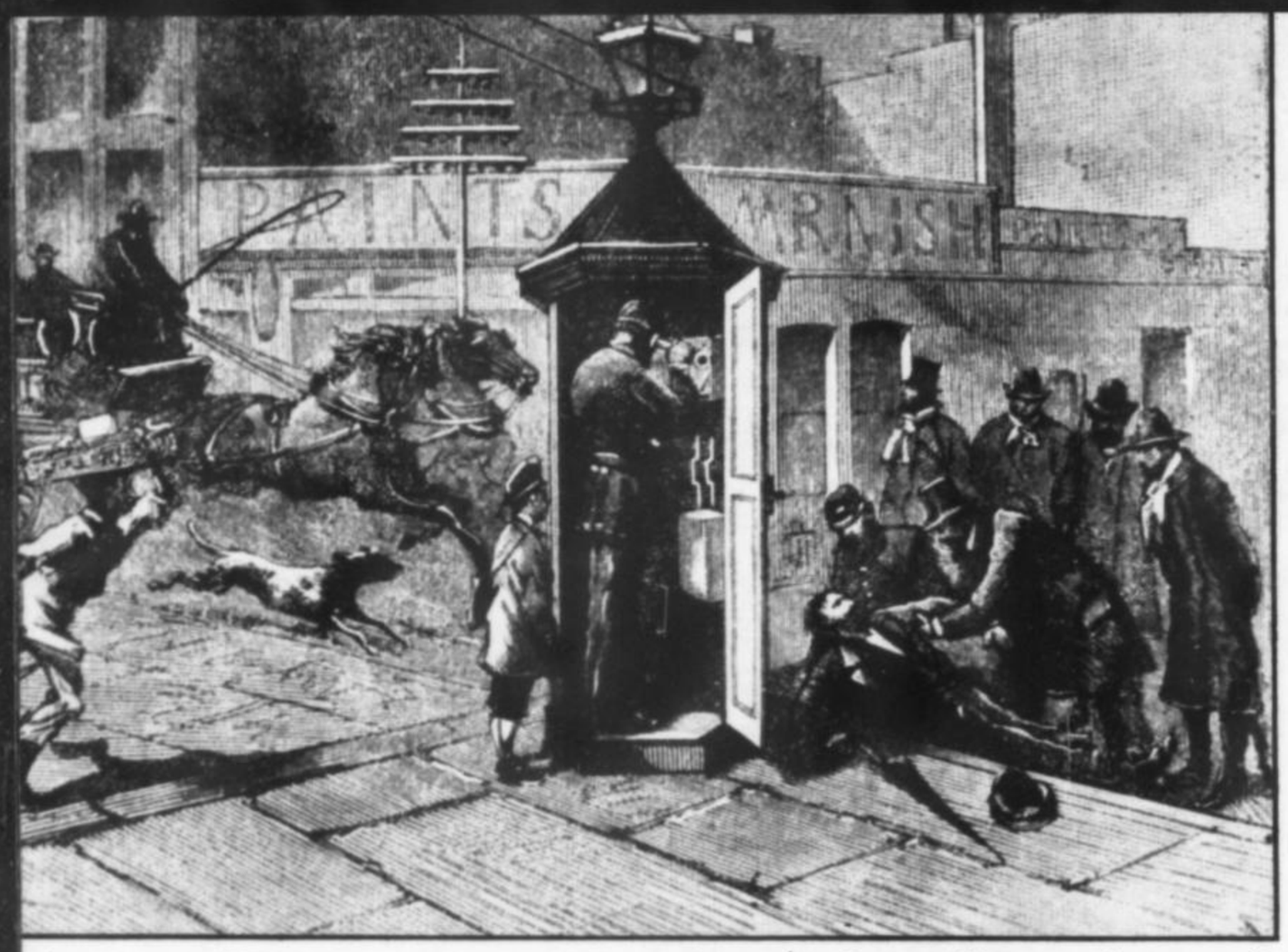
The advent of the Space Age has thrown the ITU a new challenge, since man's exploration of outer space depends on radio. To meet the new demand, the Union held a special world Space Radiocommunication Conference in Geneva in 1963, at which more than 6,000 megacycles were allocated for outer space (roughly speaking, 15 per cent of the entire radio frequency spectrum).

Thus, this period of a hundred years, which began with those who wanted to hear faster from abroad, has been rounded off with those who want to listen closer to the stars.

A hundred years of international co-operation. It can be seen in the regulations which govern the operation of telegraphy, telephony and radio around the world. It can be seen in the acceptance by ITU member countries of the radio frequency allocations which determine the assignments they themselves make to their own radio stations. It can be seen in the work of the ITU Plan Committee which is drawing the blue-print for a future world network in which telephone subscribers will be able to dial each other from anywhere to anywhere. It can be seen in the Union's Technical Co-operation programme which is training the engineers of new countries in the newest of techniques. It can be seen in the simple fact that it is possible to telephone to another country or listen to a foreign radio programme.

A hundred years of international co-operation which has helped to make possible the amazing scientific and economic progress of this last century and which has, in the quiet succession of its practical achievements, established the Union as a prototype of the sane collective future that we seek.

In celebration of its centenary, the International Telecommunication Union, in Geneva, is publishing a special book on the story of communications, "From Semaphore to Satellite", by Dr. Anthony R. Michaelis.



ITU

Chicago, 1893. At the scene of an accident a policeman calls for assistance from one of the newly-installed phone booths.

FROM TELEPHONE TO TELLY-PHONE

Echoes from the astonishing world of telecommunications

■ Whose call gets priority ?

The ITU Telephone Regulations lay down the following priority for telephone calls:

1. — Distress calls on land, sea or in the air, and World Health Organization calls concerning epidemics.
2. — Certain United Nations calls.
3. — Lightning Service Calls (restoration of disrupted telephone services).
4. — Lightning Government Calls.
5. — Lightning Private Calls (triple charge).
6. — Urgent Calls (Government, service and private, in that order) charged at double the normal rate.
7. — Ordinary Calls.

■ SOS from the cosmos

The first conference to allocate frequency bands for space radiocommunication was organized by the ITU in Geneva in 1963. The conference recognized that flights by space vehicles or manned satellites were likely to increase and that the search for and rescue of the occupants and recovery of the vehicles presented problems similar to those of ships and aircraft in distress. It selected the frequency of 20 007 kc/s for

Though they face each other across a table these two men could be sitting thousands of miles apart to demonstrate the new Picturephone—the telephone of tomorrow. Man sitting across the table uses a conventional handset. Man in foreground uses speakerphone which picks up his voice by microphone and lets him hear by loudspeaker. Sending and receiving equipment is in table control unit, used for calls and to control video screen.

search and rescue to augment those already designated for distress. It also agreed that the conventional international distress signal of ships and aircraft (SOS in radiotelegraphy and MAYDAY in radiotelephony) should also apply for the time being to space vehicles.

■ Our 170 million telephones

In 1954 there were 90 million telephones in the world. Today there are over 170 million. By the year 2000 there will probably be 600 million. Thus the idea of a global telecommunication network is now becoming a reality. To deal with the immense problems of numbering, switching, signalling and transmission and to estimate the likely growth of international traffic and to arrange its handling and routing, the ITU has set up a World Telecommunication Plan Committee. The ITU is the world forum for discussions on telecommunication matters, but the operation of international links is the concern of national administrations and private companies.

■ 300.000 km/sec is still too slow

In communications with distant satellites (or stars) the propagation time of radio waves (300,000 km/sec) is of major importance. If a relay satellite is used for voice transmissions, a delay of almost three-tenths of a second occurs between the time of speaking and the reception of the words. In an earth-moon link the delay is approximately 1.3 seconds. These delays in transmission are doubled for two-way communication. Fortunately there are now techniques to counteract and minimize these difficulties.

USIS

■ Dialing anywhere in the world

The cornerstone of the future world-wide automatic and semi-automatic telephone service is a numbering plan designed to take care of estimated telephone development beyond the year 2000.

The plan groups ITU member countries into eight regional zones and allots each country a telephone number, the first digit of which is the number of its zone. These zone numbers are: North America (1); Africa (2); Europe (3-4); South America (5). South Pacific (6); U.S.S.R. (7); North Pacific (8); Far East and Middle East (9). The figure 0 is reserved as a spare code.

To compose a complete world number a subscriber would have to dial between 13 and 15 digits. For example, anyone wishing to call ITU Headquarters in Geneva from outside Switzerland would have to dial the following number: first the world access code number that connects him to his own country's international exchange (two or three digits); 41 (code of country being called); 022 (Geneva); 34.70.00 (ITU Headquarters in Geneva).

Calls put through the world network will pass through international automatic exchanges containing "memories" used to store numbers being dialed.

■ Men to man the networks

In many countries the efficiency of the telecommunication network is not improving rapidly enough to satisfy either national or international needs. The ITU has been working to remedy this situation in co-operation with the U.N. Expanded Programme of Technical Assistance and the Special Fund. Missions have been sent to study special problems and to advise governments on communication development. The ITU has organized training courses, sponsored fellowships and seminars and has supplied training and demonstration equipment. Thirteen ITU-Special Fund telecommunication training centres are now operating; four more are in the planning stage, including one in Thailand.

CONT'D ON NEXT PAGE

■ Chatterbox satellites

Nothing can be done in the use of outer space without the help of radio—at present the sole link between earth and satellites. Good communications are actually more essential for space use than for maritime or aeronautical services. No signals mean no information and no way of knowing what is happening aboard a satellite. Reduced to silence a satellite becomes a mere pebble in the cosmos. Conversely a satellite that cannot be made to stop transmitting may take up one or several frequencies and interfere with other transmissions. A garrulous satellite can be a danger as well as a bore.

■ Place for space on the radio waves

Transmissions from spacecraft can cover wide areas because of the altitude and orbital periods of the space vehicle. A satellite placed in low orbit, for example, passes regularly over the same areas, depending on the tilt of its path. Placed in equatorial orbit at an altitude of about 37,500 kilometres, it "sees" 40% of the earth's surface throughout the 24 hours of the day. Thus in these zones space services must be alloted frequencies that will not interfere with transmissions by other services.

■ Listening for a feeble voice

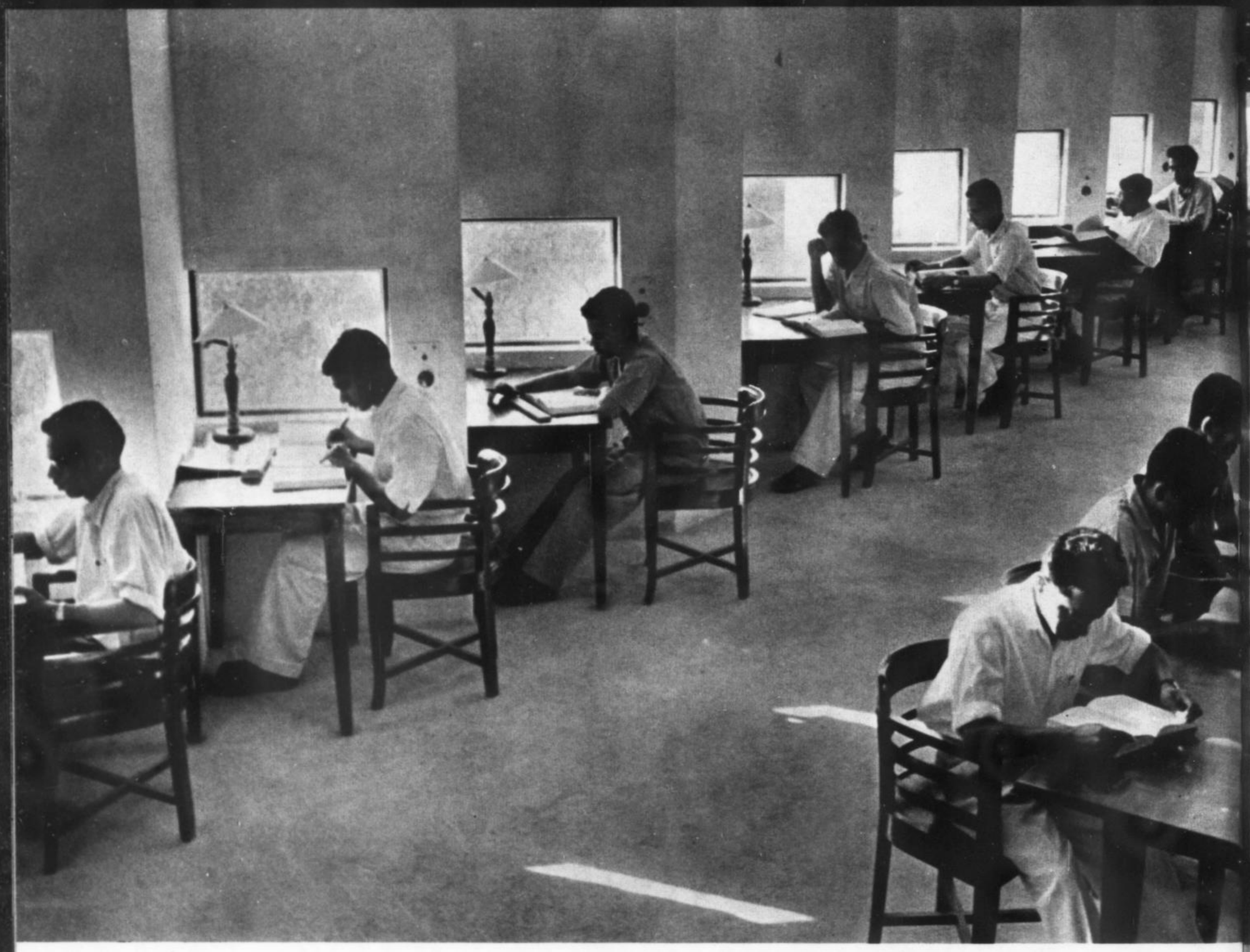
Communication between spacecraft and the earth is affected by distance. Power sources on board a satellite are relatively limited which in turn affects the range of its transmitter. Because transmissions from satellites often reach the earth as weak signals, ground receiving stations need special protection against interference that could make messages from space inaudible.

■ New dimension in communications

The growing number of spacecraft being launched into orbit and the development of space programmes in many countries create increasing demands for new frequency allotment. Only international agreement can save communications with outer space from becoming the next victims of radio spectrum congestion and also protect existing services from interference. With the launching of the first satellites the ITU took up the problems of space communications. Its vast new, responsibilities have been formally recognized by the United Nations which has called the attention of all member states "to the importance of the action taken by the International Telecommunications Union in the peaceful uses of outer space."

TUNED IN TO OUTER SPACE. In this striking photograph of the Paris Observatory's radio telescope at Nançay, France, stars formed the myriads of white tracks as the earth turned during the three-hour time exposure. At the centre of the circles is the Pole Star. Radio telescopes are used by scientists to study radio waves from outer space in the new science of radio astronomy. Since the first artificial satellites were launched in 1957 radio telescopes have also been used to track satellite flights, because of the sensitivity and precision of their giant antenna.

CSF - René Bouillot, France



ENGINEERS IN THE

The Bombay Institute of Technology

THE Republic of India needs thousands of technicians for the many industries now developing all over this huge sub-continent. To try to meet part of these enormous needs the Indian Government has set up five regional technological institutes. One of these top-level engineering schools is the Indian Institute of Technology, Bombay (1).

As part of its technical assistance programme, Unesco has given India large-scale aid in setting up the Bombay institute. In 1955, an agreement was signed to enable Unesco to use a contribution in roubles by the Union of Soviet Socialist Republics to the United Nations Technical Assistance Fund to aid the institute. It was foreseen that

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(1) Editor's note: India's other technological institutes have been set up at Kharagpur (with aid from U.S.A. and U.K. and U.N. technical assistance through Unesco); at Delhi (with aid from U.K.); at Kanpur (with aid from a consortium of U.S. universities) and at Madras (with aid from the Federal Republic of Germany).

The administration building of the Bombay Institute of Technology (above) dominating the campus of this engineering school was designed by the Indian architect, G.M. Bhuta. The severe lines of reinforced concrete construction are softened by elements of traditional Indian style. Only seven years ago the site was covered by jungle vegetation. Left, one of the two vast reading rooms of the central library, which has over 60,000 books.

Photos Unesco - Boucas

E NEW INDIA

by Vadim A. Javoronkov

aid amounting to $3.5 million would be provided over five years, but assistance has actually amounted to over $4.5 million. In addition, the Soviet Union has donated equipment worth three million old roubles. On its side, India has spent an estimated $10 million on the institute, more than doubling the international aid received.

Soviet specialists have helped the Indian Ministry of Education in working out a project for the institute, including workshops and laboratories. The Indian Government undertook the full task of building the institute and Unesco provided equipment for the main laboratories and workshops and helped to organize academic and scientific activities.

From these combined efforts a university city has sprung up on the shores of Lake Powai, in an area where signs still warn swimmers of the danger of crocodiles. The institute is located 18 miles from the heart of Bombay on a site that only seven years ago was a jungle wilderness.

Building operations were already in progress when India's

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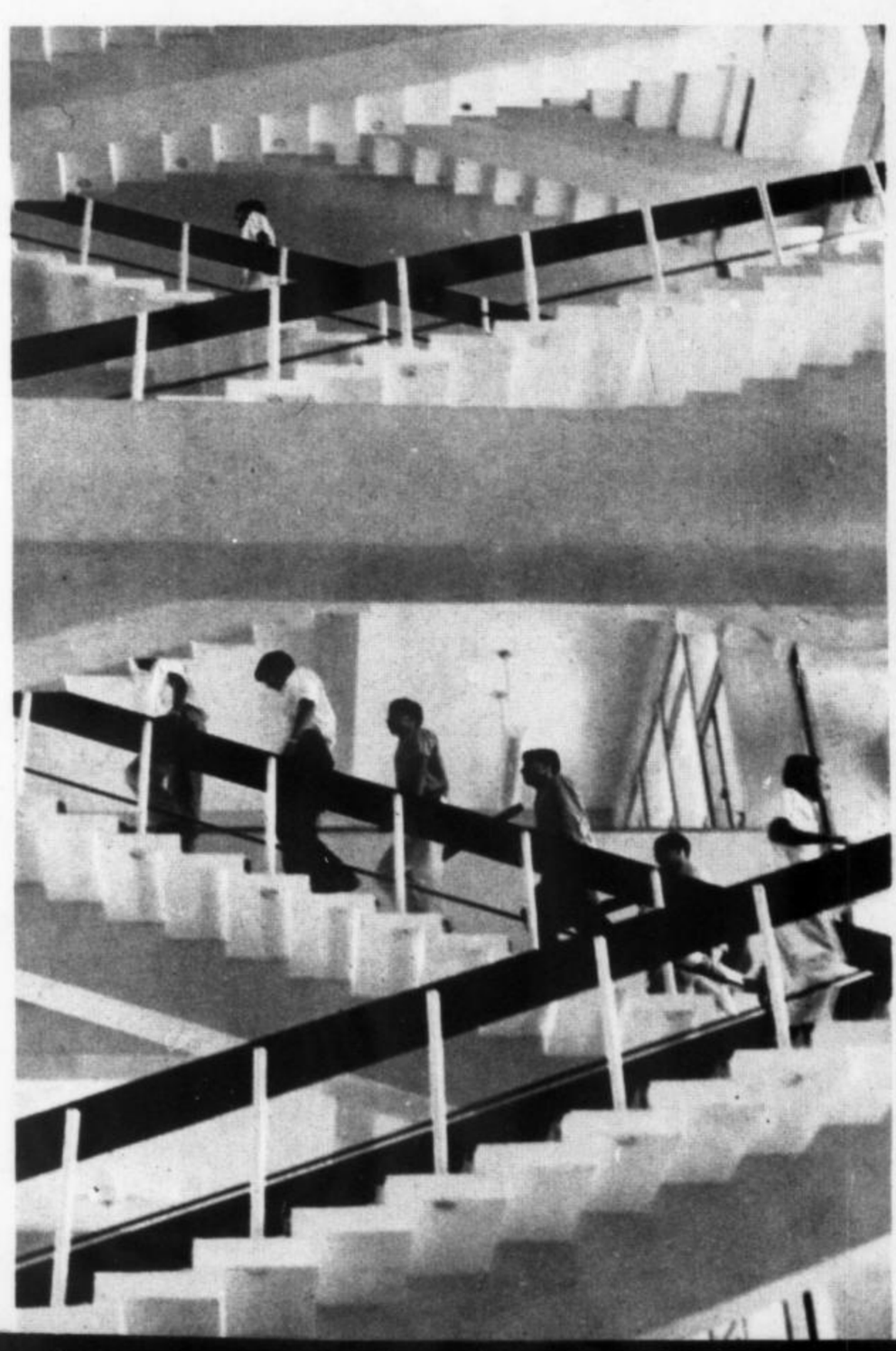


Eight faculties, 2,000 students

Prime Minister, Jawharlal Nehru, laid the foundation stone of the main administration building on March 10, 1959. But as the need for engineers was so great the institute had not waited for buildings to be completed. The first students were enrolled in 1958 and in July of that year the first classes were started in temporary premises in Bombay.

The installations at Powai are now an impressive sight. The dominating feature of the new campus is the administration building which combines the clearcut lines of modern architecture with elements of the traditional Indian style. Reinforced concrete slabs jut out to give protection from the sun and an efficient ventilating system keeps the interior cool and fresh.

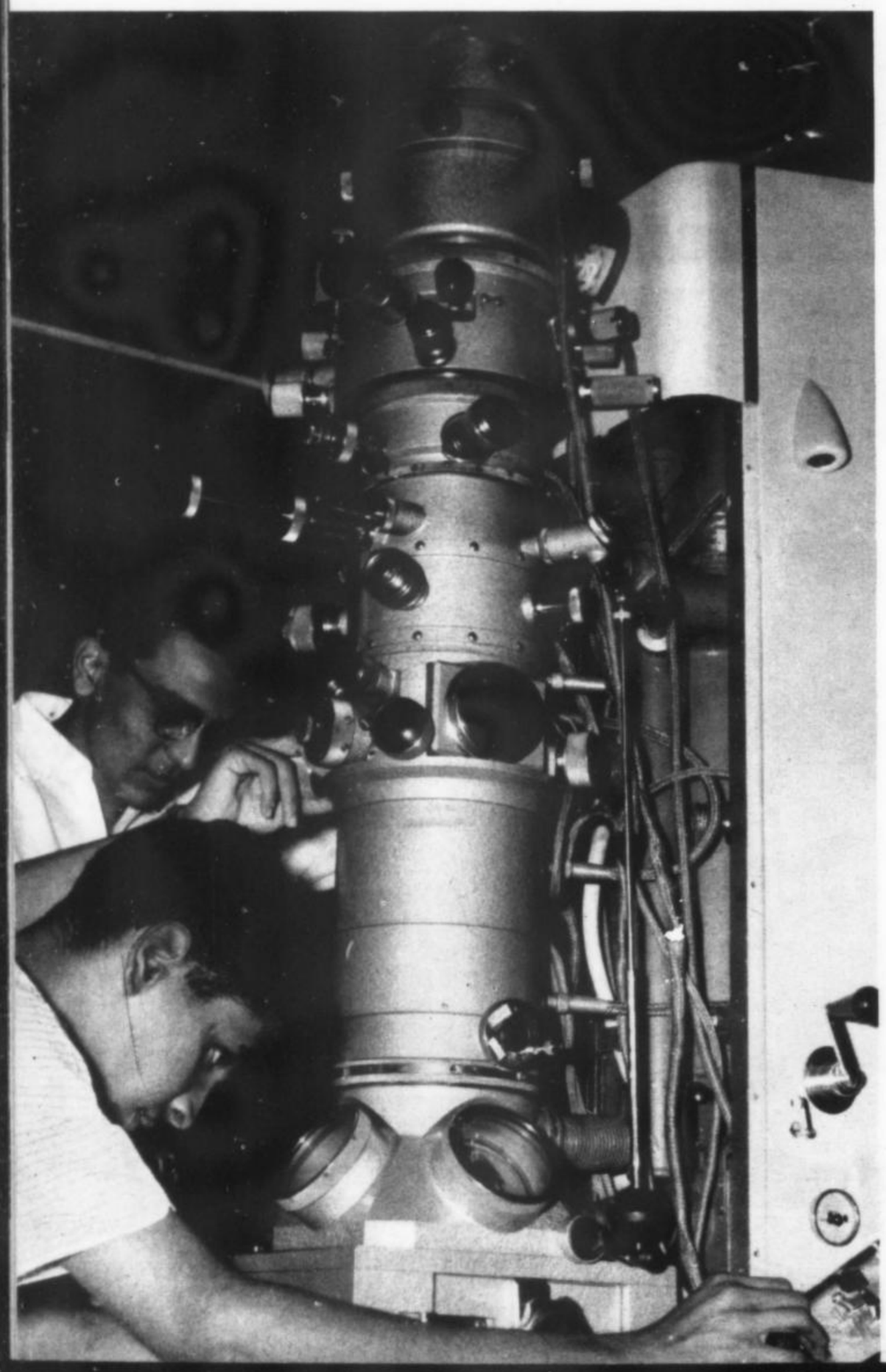
Behind the administrative centre, covered passages giving protection against blazing sun and tropical monsoon rains link a series of buildings with striking sawtoothed roofs: mechanical workshops and the laboratories of the mechanical and metallurgical departments.

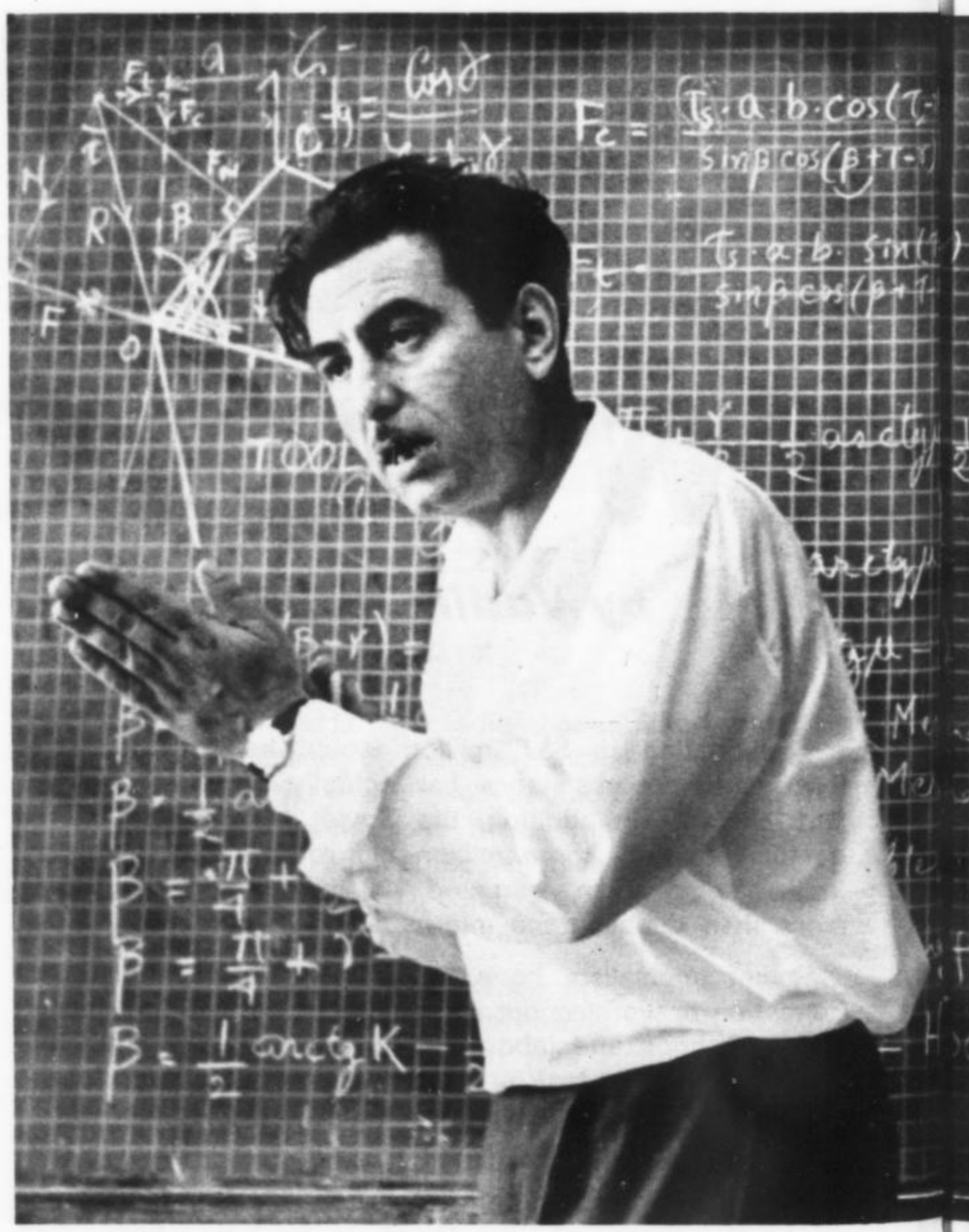
The institute has other impressive-looking installations. A water tower, rising like a lighthouse above the campus, stands alongside the hydraulic laboratory. In the heavy machinery shop is a giant travelling crane. There is also a thermal station which services the turbine laboratory. Few other technical institutes, even the most modern, can boast such a harmonious blending of light and space and the latest technological equipment.

EQUALLY striking are the architectural forms of a conference hall, seating 2,000 people, which faces the main entrance of the institute. Through the palm and mango groves between the foothills and the shores of the lake gleam the dazzlingly white walls of the student hostels. These provide separate rooms for all undergraduate and postgraduate students, and each building has its own dining hall, games room and reading room. The hostels are set around a great sports field with a gymnasium and stands for spectators. Track and field athletic events, volley ball and hockey are among the most popular of the student's sporting activities.

The central library is housed in a three-storey building. It has two large reading rooms, each seating 250 persons, and over 60,000 volumes, including India's largest collection

Unesco - G. Mull





Left, post-graduate students operating an electron-microscope in the metallurgical department of the Bombay institute. Supplied by the U.S.S.R., under the U.N. - Unesco technical assistance programme, it magnifies specimens 100,000 times. Above, Professor Y.N. Loladze, a Soviet specialist in machine-building technology, head of the Unesco mission in Bombay in 1962 and 1963. "The purpose of the expert here," he once said, "is to work himself out of a job."

of Russian technical literature (5,000 works) from which books are loaned out to other Indian institutions.

Members of the faculty and technical staffs will live in small houses and in buildings comprising two and four-room flats now under construction.

The university city has now a population of 6,000 and as its numbers increase more and more buildings rise on the campus. The speed of this development owes much to the organizational skill and energy of the director of the institute, Brigadier S.K. Bose, ably supported by his second in command, Professor Kamooth, and the institute's registrar, Mr. Nera. Brigadier Bose pays special attention to the living conditions of teachers and students, and the results of his efforts can be seen in the increasingly fine academic record of the institute.

The project for technical assistance to the Bombay Institute was financed by Unesco from the Soviet contribution to the U.N. Expanded Programme of Technical Assistance. Deliveries of Soviet equipment paid for by these funds include an electron microscope with a magnifying power of 100,000, highly sensitive instruments for use in electricity and physics, precision metal-cutting tools and 100 and 200-ton hydraulic presses. The long list of equipment includes such diverse items as an automated rolling mill, an oxygen station and refrigeration units, and a continuous metal teeming machine, closed circuit television and high frequency heating apparatus.

These modern devices and machines are used to train junior students in the fundamentals of the technology of metals (cutting, welding, casting, forging, etc.) and to help senior students familiarize themselves with the basic processes and operations in their chosen specialities. This specialized equipment is provided on a lavish scale and enables the institute to cover a broad spectrum of research.

THE institute has reached a planned enrolment of 2,000: 1,600 undergraduate and 400 post-graduate students. It has eight departments: chemical engineering, civil engineering, electrical engineering, mechanical engineering, metallurgical engineering, physics, mathematics and humanities.

Students complete a five-year course to gain a bachelor of technology degree, and then go on to take a two-year course for their master of science degree.

The institute now trains students in twenty-six major specialities some of which are quite new to India. Their training is in the hands of 170 Indian teachers and eight

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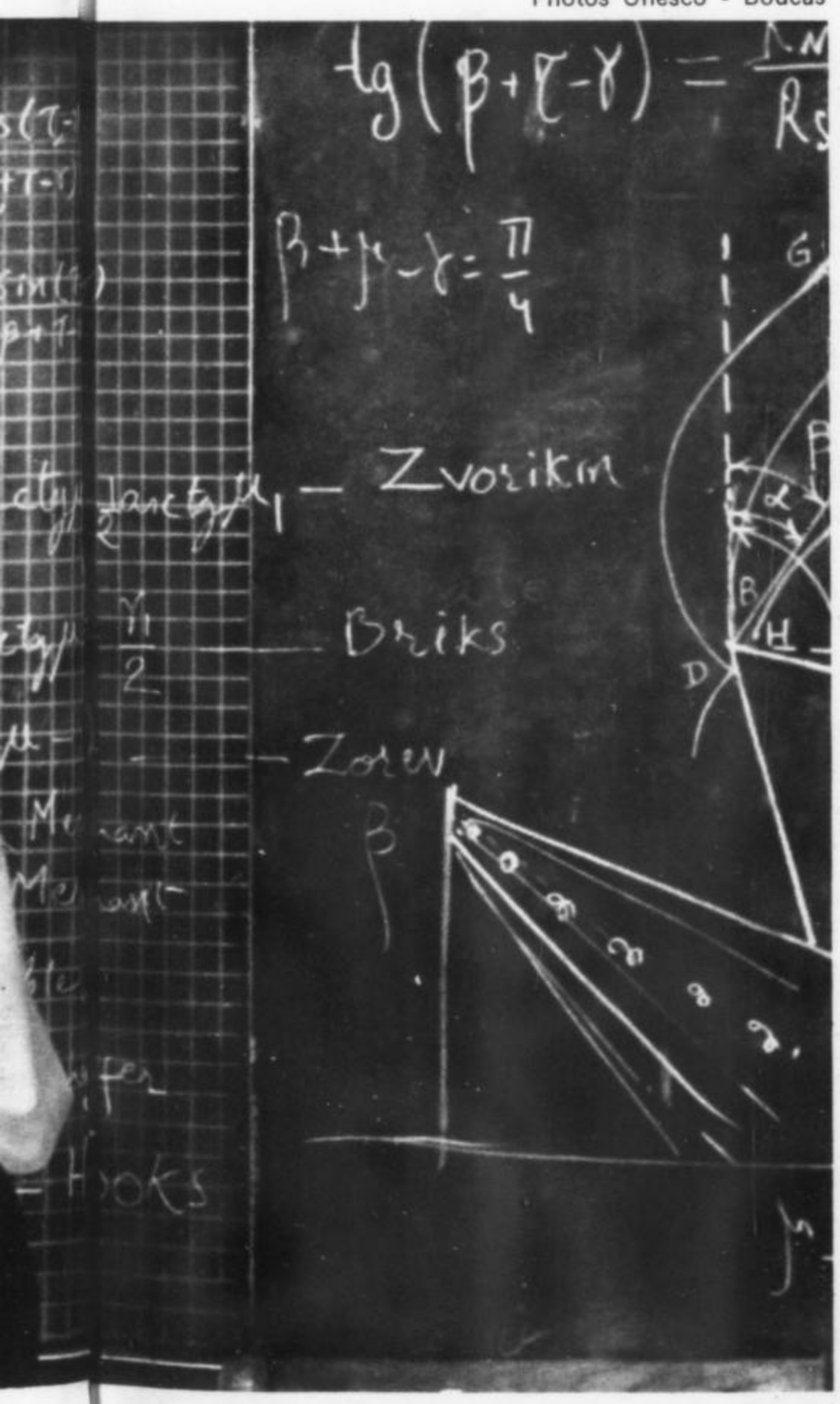
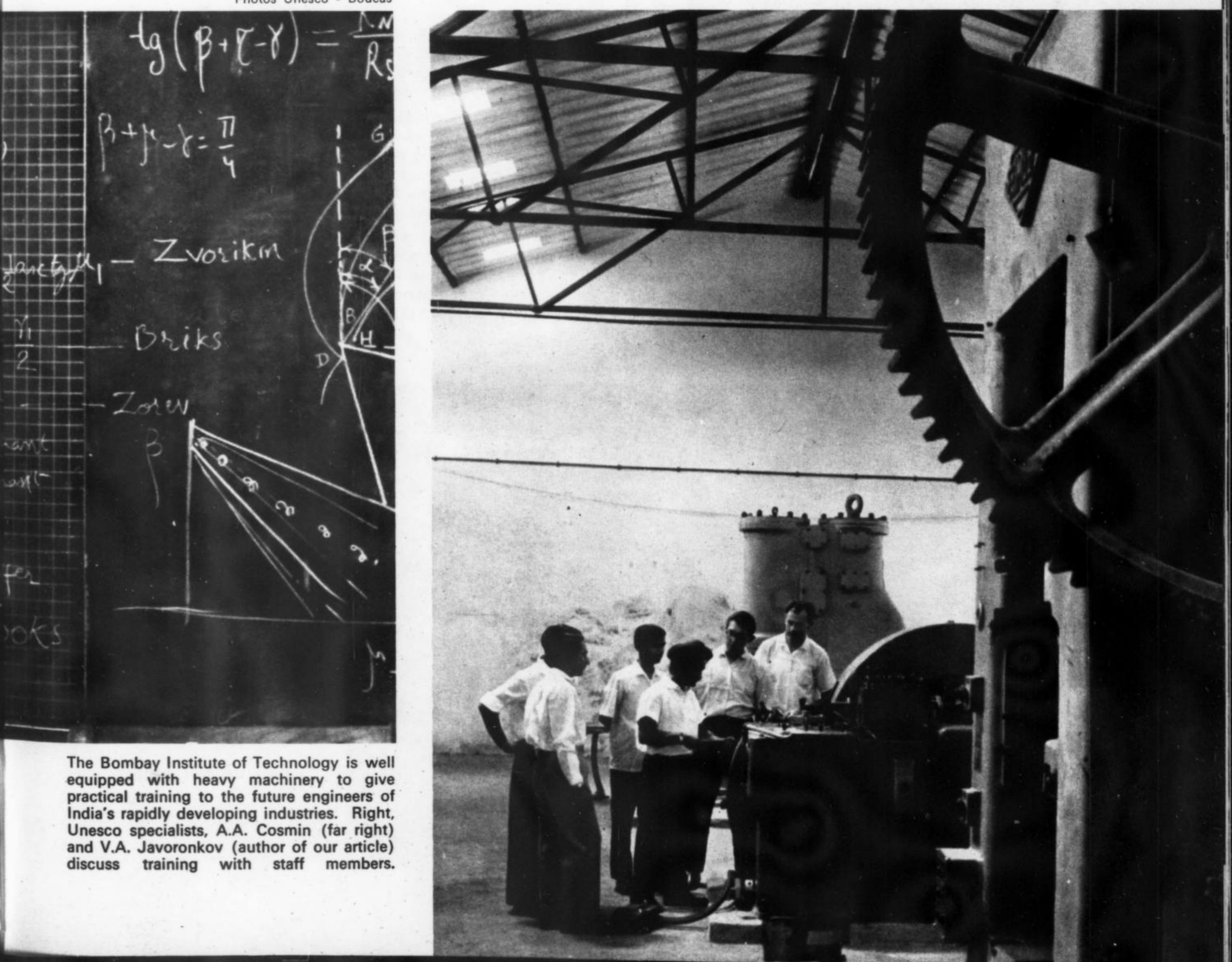
Photos Unesco - Boucas





The Bombay Institute of Technology is well equipped with heavy machinery to give practical training to the future engineers of India's rapidly developing industries. Right, Unesco specialists, A.A. Cosmin (far right) and V.A. Javoronkov (author of our article) discuss training with staff members.

The rehabilitation of a long-disdained genius

CARAVAGGIO

Portrait of Caravaggio, by Ottavio Leoni

Marucelliana Library, Florence

CARAVAGGIO, the 16th-century Italian artist, now occupies a special place in the history of art. Long considered as a minor artist, accorded only the status of a painter of works "for the curiosity shop", Caravaggio has now been rehabilitated. During the past thirty years he has increasingly been recognized as one of the revolutionary geniuses of Italian art. Today, art historians trace, within the vast perspectives of world painting, his influence on such masters as Velasquez, Vermeer and Georges de la Tour.

Caravaggio was a key figure in the development of baroque painting but, with the decline of this art style as tastes and fashion changed, his works fell from favour and finally into disrepute. By the end of the 19th century "Caravaggism" was being attacked as strongly by the "naturalists" as by those who preferred academic art, though for quite different reasons. It was restored to a worthy place in the Pantheon of the world's art thanks largely to the efforts of two Italian art critics, Roberto Longhi and Lionello Venturi, in the first quarter of the twentieth century. Six major Caravaggio exhibitions have been held in the past 14 years.

The ups and downs of Caravaggio's posthumous career were in a way postscripts to his stormy, turbulent life which, when it ended in 1610, seemed to have been marked during most of its brief course by shocks and scandal. There was so much about Caravaggio that was scandalous: his wealth of talent, the excesses of his Bohemian mode of life and, apart from his revolt against the aesthetic standards of his time, his new and disturbing view of the world, which so antagonized many of his contemporaries. For he suddenly revealed human beings as nature has made them and not as the classical art style then decreed.

The son of a mason, Caravaggio was born in 1573 in the village of Caravaggio near Bergamo in northern Italy. His real name was Michelangelo Merisi, but as was common in his day, he later took the name of his birthplace.

When he was eleven years old he was apprenticed to a painter from Bergamo, Simon Peterzano, who worked for many years in Milan. Caravaggio was sixteen or seventeen when he finally set off for Rome, then the dominant artistic centre of Europe.

With the Renaissance, classicism in art was again in favour, a fact of which the young Caravaggio took no heed whatever. This is reflected in his early works, particularly in one he painted in 1590 when he was seventeen. Every detail of "Rest on the Flight to Egypt" reveals a taste for naturalism and a lyrical affection for nature.

In Rome, Caravaggio worked in the studio of Cesare d'Arpino, a celebrated artist and teacher. For his master's patrons he painted fruit and flower subjects, but also from his brush came minor masterpieces: "Boy with a Basket of Fruit" and "The Young Bacchus".

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Left, The Supper at Emmaus (detail). Caravaggio made several paintings of the meeting between Christ and his disciples at Emmaus. This version is now in the National Gallery, London.

Unesco Catalogue of Colour Reproductions

Colour page, opposite:

Detail from the Martyrdom of St. Matthew. French Church of St. Louis, Rome.

Centre colour pages:

Christ Calling St. Matthew. French Church of St. Louis, Rome.

Photos © Arts graphiques de la Cité, Paris

'Angry young man' of the Renaissance

A Roman prelate, Cardinal del Monte, now became interested in the talented young artist, and commissioned from him three paintings depicting the life of St. Matthew, for the Contarelli Chapel of the Church of St. Louis, in Rome.

In these works, executed between 1597 and 1600, the full measure of Caravaggio's genius was at last revealed. By his incomparable treatment of contrasts, by suddenly infusing deep shadows with pools and shafts of piercing light, he gave his paintings a startling effect of movement. In this dramatic **chiaroscuro,** figures and objects acquired a new wealth; his brush conjured up a new dimension.

Caravaggio's first religious paintings caused a scandal. People called them vulgar and were shocked because the models were no longer the idealized types used by Caravaggio's predecessors. He had simply taken them from among the ordinary people he met in the streets: old women with faces marked by hardship and adversity, fresh-faced adolescents, young men looking astonishingly like today's "mods" and "rockers", innkeepers, ragged wastrels. In Caravaggio's hands, refined-looking, evanescent Madonnas were transformed into sturdy peasant women suckling infants, and saints became ordinar men.

The abrupt gesture, the suggestion of violenc so displeasing to delicate and refined tastes, the retur to a world of physical reality shorn of every artifice, all, nevertheless, tell of a love of humanity that still has the power to move us three centuries later. Perhaps Caravaggio's great secret, the very source of his inner power, was his compassion, his ability to feel the emotions of others, to suffer with them. He was indeed an "angry young man" of the Renaissance whose "rage for life", paradoxically, concealed a terror of death that only showed clearly in his final works.

What displeased Caravaggio's contemporaries far more than the "tricks" with light and shade was the presence in his paintings of such convincingly life-like figures, the sudden intrusion into the sacred of the everyday, as in the "Crucifixion of St. Peter" and the "Conversion of St. Paul." Yet the noblemen of Rome went on buying his paintings. Caravaggio was now famous, but still a controversial and often disparaged figure. His fellow painters observed him closely, recognizing a novator.

Caravaggio haunted the ill-famed quarters of Rome. He became involved in brawls and was haled before the courts. In one of these fights he killed a man. At that moment all Rome was talking about his painting, "Death of the Virgin" (today in the Louvre Museum). Caravaggio had had the audacity to depict Mary as a coarse, vulgar street woman. Some even hinted that he had used as his model the corpse of a courtesan taken from the River Tiber.

Caravaggio was forced to flee from Rome after his fatal brawl. He went to Naples, then to Malta where, in 1608, he found an enlightened patron in the Grand Master of the Order of Malta. He went on painting—and brawling. Leaving Malta he returned to Naples from where he began to make his way back to Rome. But on reaching Port 'Ercole he fell ill. Desperate and alone, he died at the age of 37.

In these last years he painted "The Beheading of St. Jean the Baptist" (Malta), "The Entombment" (Syracuse) and "Resurrection of Lazarus," (Messina) three masterpieces immersed in the light of tragedy, their figures enveloped in the silence of the vast empty space that hangs over them.

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Above, The Flight to Egypt (detail). Caravaggio painted this work when he was 17. (Doria Pamphili Gallery, Rome). Below, Narcissus at the Fountain. (National Art Gallery, Barberini Palace, Rome.)

Unesco Catalogue of Colour Reproductions

Colour page, opposite:

St. John the Baptist. National Art Gallery, Corsini Palace, Rome.

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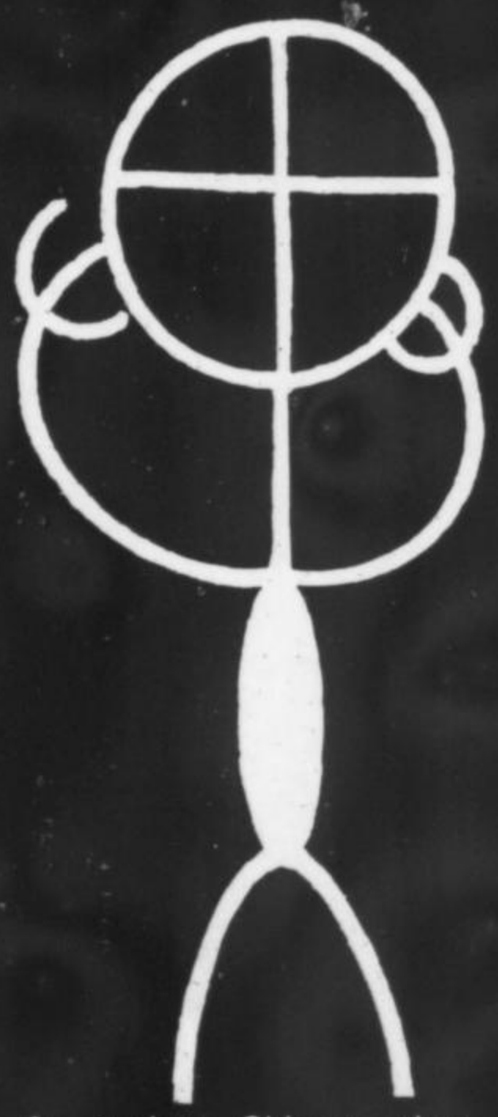
THE ANCIENT WORLD

Volume II of the Unesco-sponsored History of Mankind appears this month. The Unesco Courier is happy to offer its readers a preview of this new work.



An ancient Chinese character meaning "different".

THE Unesco Courier is pleased to announce the publication this month of The Ancient World, **Volume II of the six-tome** History of Mankind, **produced under the auspices of Unesco.**

The Ancient World **(published thus far in English) tells the story of the momentous years between 1200 B.C. and 500 A.D. In this period came the rise of the great civilizations of China and India and of Greece and Rome, and the early years of Christianity.**

To prepare this volume, the Unesco-sponsored International Commission for a History of the Scientific and Cultural Development of Mankind, called on Professor Luigi Pareti of the University of Naples. Professor Pareti, who died shortly after completing the work, was assisted by Professor Paolo Brezzi of the University of Naples, who wrote on the origins of Christianity, and Professor Luciano Petech of the University of Rome, who was responsible for the chapters on the civilizations of India, the Far East and Central Asia.

Volume I of the History of Mankind, **dealing with prehistory and the beginnings of civilization, was the work of two archaeologists of world-wide reputation: Jacquetta Hawkes and Sir Leonard Woolley (see The Unesco Courier, June 1963).** The Ancient World **picks up the threads of their story and follows mankind along the road of progress and civilization. What it offers as it moves through the centuries is a global view of man's positive achievements: the evolution of language, art, transport, medicine, trade, architecture, science and religion.**

As Mr. René Maheu, Director-General of Unesco, writes in the foreward to this volume: "The ambition to write a universal history is a very old one indeed. Many have tried their hand at it... not without merit, nor without success. However, this History of Mankind **parts company with its predecessors on several essential points. In the first place it deliberately confines itself to shedding light on one of mankind's many aspects, its cultural and scientific development. In doing so it departs from the traditional approaches to the study of history which, as we know, attach decisive importance to the political, economic and even military factors. It offers itself as a corrective to the ordinary view of man's past."**

The story of man which fills the 1,200 pages of this new three-part volume of the History of Mankind **thus presents history in a different perspective. It takes the reader on a journey to the places of Antiquity, including China, Persia, India, Eturia, Egypt and Carthage. It describes, for example, what it was like to belong to one of the constantly shifting populations of the Steppe civilization, how the alphabet was first codified, how man began to compose music, write poetry and create works of art, how trade and industries developed.**

The Ancient World **is a vast and colourful mosaic whose ensemble reveals, most significantly of all, the contributions made by different peoples and regions to the cultural rise of mankind during nearly 2,000 years of history:**

- **Medicine as practised in Greece by Democedes, Diogenes and the father of medicine, Hippocrates**
- **The first production of pottery, glass and enamel**
- **The houses and towns of the Romans, so well planned that many still exist**
- **Ingenious inventions like the device used by the Chinese to measure earthquakes in the first century A.D.**
- **The evolution of democratic ideas and institutions in Greece and Rome**
- **Indian, Chinese and Arabic contributions to mathematics and astronomy... to name but a few.**

To offer readers a preview of this latest volume in a series of historical works that have been termed, "an international publishing venture of unparalleled importance," The Unesco Courier presents on the following pages passages selected from The Ancient World. **This work is published in the United Kingdom by George Allen and Unwin Ltd., London (Price £6 6 0), and in the U.S.A. by Harper and Row Inc., New York ($15.50).**

Love letter or household accounts? With her stylus, this young Roman woman makes a gesture characteristic of reflection. The stylus, a sharpened reed or a pointed instrument of bone or ivory, was used to scratch letters on soft wax tablets like those held by this woman. Tied together by cords, these tablets formed a small note-book called a "codex." The Romans also wrote on parchment and on paper made from papyrus pulp (Mural at Pompeii, 70 A.D.).

© Handke, Historisches Bildarchiv, Bad Berneck, Federal Republic of Germany.

ANCESTORS OF THE BALL-POINT PEN

by Luigi Pareti

ORIGINALLY the Chinese wrote with a bamboo reed sharpened and cut like a pen: the matter written with this had to be of uniform thickness. On the bones employed in divination characters were incised with a metal point. But the writing-brush, although its invention is traditionally ascribed to Meng-T'ien under the Ch'in dynasty (third century B.C.), already existed in the twelfth century. It is not only represented on a pictogram of Anyang, but at least three bones and a potsherd carry characters traced with a brush. So Meng-T'ien did no more than perfect the shape and composition of an instrument which was already in being.

Writing materials in the Middle Eastern and classical worlds were very varied. One reason was that after the invention and spread of alphabetic methods the use of writing proportionately increased, and consequently also demanded lower priced material even if it was more perishable. Naturally the increase in written documents and the lower price of writing material went hand-in-hand with the increase in the number of readers.

We start, then, with writings carved with chisels or similar instruments on rocks or plates or stone and marble stelae. They might also be cut on the fronts of buildings, or on tablets of bronze, copper, lead, or precious metal, and later on coins and weights; or again they could be scratched or tooled on tablets and seals of unbaked clay or terracotta. To these were now added other writings achieved in diverse ways.

Some were traced with the *stilus* on smooth wooden tablets, or on tablets smeared with white paint (*tabulae dealbatae*) or coloured. Others were written with the small reed called a "calamus", and with ink (*atramentum*), on light and plastic material. Leaves of papyrus pulp, or some similar substance, are an example mentioned by Pliny, and there was writing on olive leaves (the petalism at Syracuse for instance), on linen bandages (especially those used as coverings for mummified corpses in Egypt), on earthenware sherds (*ostraka*) and so on. Later on Phoenician influence was particularly responsible for the use of calf-skin for expensive documents; and sheepskin (Pergamena) came in from Pergamum in Asia Minor. Skins were used for inscribing the ancient treaty between Rome and Gabil and also for a cypher employed at Sparta: for the latter strips of skin were wrapped in a spiral on to a cylinder of given size and then inscribed, in such way that they

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Assyrian royal library of 30,000 tablets

could only be read if they were wrapped once more round an identical cylinder (*scutale*).

In ancient Egypt it was already the custom, when one wanted to write a complete document or a definitive part of a work, to paste one pressed papyrus leaf (*byblos*) on to another and so to construct long strips; these were wrapped together into a roll (*volumen*) and kept in a store (*thece*). Herodotus (II, 92) speaks of this device, though he does not tell us when Greece acquired it: probably it penetrated to Ionia in the days of Polycrates of Samos in the sixth century, and to the rest of Greece about 500. Where tablets or smoothed skins were used, they were joined together into *codices;* and these, on account of their high price, were often used more than once, the first set of writings being cancelled and a further set being written over them.

A brief note must be made about the earliest methods of writing in the American continents. Above all we must mention certain mnemonic devices, like the notching of sticks. There were the *quipus or kipus,* found especially in Peru and Bolivia, which consist of a collection of strings of different colours, with various types of knot either single or in groups: these were genuine *aides-mémoire* for arithmetical data, for calculating the days or for matters of statistical importance.

There were the *wampum* of the Iroquois in North America which consist of figured and striped embroidery. In North America too there were pictorial ideograms, carved mainly on rocks, which were used to illustrate story-telling and to keep records of arithmetical data: these often contain representational figures with syllabic equivalents and look like actual word-puzzles. Finally there are the illustrated books of Panama, Colombia, etc., which helped in the recitation of magical and religious texts.

But the Mayas and Aztecs of Mexico in early days possessed real books made of folded bark: these were covered with pictograms for ritual purposes, with calendars for divination, with tribute registers and with annalistic records. They also had stelae inscribed in bas-relief, on which pictographic and syllabic elements are found side by side.

But in all this the only objects likely to belong to late antiquity are a bas relief on a stele at Vera Cruz and an inscribed plaque now at Leyda. These are assigned by some scholars to the period around 320 A.D.

AS written documents, both public and private, became more common, and as literary output increased, it was necessary to consider better ways of preserving and consulting writings, by bringing them together in suitable places. The classes of documents in question were varied and important. The earliest which it was essential to construct and preserve were state treaties, laws and decrees, administrative acts, records of foreign relations, chronicles both lay and sacerdotal, the acts of kings, and the lists of priests and magistrates. All these were written on relatively durable materials and were collected in royal palaces, or in temple precincts and sacristies, or in the seats of magistrates and of public assemblies.

Collections of official documents of these kinds are known from finds. In Egypt the so-called Tell el Amarna archives (14th century B.C.) contained the correspondence with subject regions and neighbouring powers from the time of Amenhotep III. In Crete we have the archives of the Minoan palaces, and in the Hittite empire the archives of the kings and leading cities.

In the ensuing period proper libraries came into being, or at any rate departments for the preservation of literature which adjoined the archives. One of the most characteristic libraries known to us is that of Ashur-banipal (668-630), who put on to its contents his stamp of ownership, his "ex libris". Among these are 30,000 tablets of documents contained in chests arranged on shelves. These include receipts, levy lists, and his official and private correspondence. But in addition there are pieces of epic and mythological poems; of liturgies and prayers; of magical writing, psalms, oaths, and auguries; of annals, chronicles, and lists of dates; of works on grammar and dictionaries; and of astronomical calculations, tables of weights, and other arithmetical writings. The king had sent scribes to many places to copy ancient tablets. Another noteworthy library is that of Nippur; and there were others owned by private persons and by temples.

These Assyrian archives and libraries probably had their precursors at Babylon and Bogazköy. They were followed by similar institutions in the Persian capitals, among which we know best the one instituted at Persepolis in the days of Darius I.

THE first collections of literature, and therefore the first libraries, in the Greek world must have been made in the time of the sixth-century tyrants, Polycrates of Samos and the Peisistratids of Athens. Later on we are told of libraries belonging to individual literary men, of whom the first is Euripides.

At the same time archives to preserve copies of important private documents were on the increase. Examples of such documents are conveyances, boundary plans, manumissions, adoptions, and wills.

Education and the system of schools were also feeling the effect of writing, and of written documents and work.

In early days the traditional ideas about religion and techniques were learned in the family, or in priestly colleges, or in unions of artisans, by means of mnemonic methods. The teaching was oral, and the pupils committed to memory what they learned. In our period this was still the stage reached in education in India. The Indian system of education was developing along clearly defined lines. Writing was not used for religious purposes, and oral tradition was therefore completely supreme: yet instruction was confined to sacred matters. The study of the *Veda* was given only to the first three castes, the Sudra being excluded. From the beginning we see the sacred texts being taught by a master and repeated by the pupils in chorus "like the croaking of frogs" (Rigveda, VII, 103). In Vedic times the religious students (*Brahmacarin*) were the educated class of India.

Their duties were to study the *Veda,* to serve their Brahmin masters (*guru*), and to maintain chastity. In very early times the acceptance of a student into a school was conditioned by a complicated initiation ceremony, the *upanayana,* through which the pupil received his second (spiritual) birth and was therefore twice-born (*dvija*). In the Late Vedic period supplementary subjects, such as mathematics, grammar, and prosody, were added to the curriculum. Education was originally confined to the Brahmins, but was widened as time went on to include the *Ksattriya* and *Vaisya* too: towards the end of our period a genuine intellectual aristocracy came into being, with the *Ksattriya* occupying a position at least equal to that of the Brahmins. These are the circles in which Upanisadic thought took shape. The *sutra* of Late Vedic times prescribe a detailed curriculum, which already embraced all traditional Indian knowledge, that is to say the six *Vedanga* (phonetics, ritual, grammar, etymology, prosody, astronomy), together with other ancillary sciences.

GURU AND DISCIPLES. A 13th century stele of polished stone from Konarak, Orissa, India depicting a Brahmin teacher (guru) of ancient India, explaining the meaning of religious texts to his pupils, These oral lessons, at first restricted to religious matters, were later expanded to include mathematics, grammar and scientific subjects.

© Victoria and Albert Museum, London

With other peoples, however, the use of writing became an aid to education at an earlier stage. With some the basis of education remained theocratic, for instance in Egypt or among the Hebrews—especially after the Captivity, when it was carried on in synagogues. On the other hand in the Graeco-Roman world lay education predominated; it was sometimes private and sometimes public, the many forms it assumed being dictated by the varying bents and environments of the different peoples.

Within the precocious culture of the Ionian Greeks we find a form apparently already known in the Homeric poems, which was intermediate between instruction at home and instruction at school, and which was provided by a "pedagogue" privately employed. Side by side with this there existed the genuine school, where physical education (the *palestra*) was originally the main feature but gradually tended to get separated from instruction in music and grammar.

A law of Charondas mentioned by Diodorus (XII, 12-13) is often cited as evidence that masters were paid by the state and experiments in compulsory education were already known in the seventh century; but in all probability this is not the original law made at Catana, but a revision of it made in the middle of the fifth century at Thurii. Doubt has also been cast on the passage of Aeschines purporting to describe Solonian legislation on education.

The first certain case of a state school, recorded by Plutarch, relates to Troezen in 480. Meanwhile particular importance was assumed by the schools of a domestic, or professional, nature which were gradually created to preserve and advance the writings of various groups—the Epic poets (Homeridai), the doctors (in the Asclepieia), the philosophers, and the mathematicians (cf. the Pythagoreans).

The Dorian world, Sparta or Crete for example, presents a contrast. There, at any rate from the ninth or seventh century onwards, the paramount feature was a militarist education provided by the state; and letters were sacrificed in favour of physical and athletic instruction.

A characteristic instance of individual arrangements is provided by archaic Rome. After the end of the domination exercised in the sixth century by the more civilized Etruscans, the well-to-do families preserved the custom of sending their sons to get instruction at Caere *(Vol. II Pt. I)*.

'THE WOODEN OX'

The world's first wheelbarrow

by Luciano Petech

Engraving of a man pushing a wheelbarrow, by a Chinese artist of the Han Period (202 B.C.-220 A.D.).

IN China engineering always remained on a practical level, without any connotation of theory. Some bits of early information are found in the *K'ao-kung-chi* (artificers' record) chapter of the *Chou-li:* the original was lost and the present one was compiled by the prince of Ho-chien (d. 130 B.C.). The larger works of mechanical engineering were as a rule connected with the imperial workshops (mostly called *shangfang*); for the rest engineering was a family and hereditary craft.

Most of our information on mechanical appliances refers to mechanical toys, which were always much appreciated in China. A very famous example of such devices was the south-pointing carriage *(chih-nan ch'ê),* in which a figure was made, by the use of cog-wheels, always to point southward; it certainly had nothing to do with the compass.

The "*li*-recording drum carriage" *(chi-li-ku-ch'ê),* a sort of hodometer, is mentioned in the fourth century A.D. and described in the *Sung-shu.* As perfected later, it beat a drum at every *li* and sounded a gong at every ten *li;* it was a simple problem of reducing cog-wheels.

Among these toys there was one destined for a great future, if only the Chinese had guessed its practical use—cardamic suspension. Only known to Europe since the sixteenth century, it seems to be described in the *Hsi-ching tsa-chi* of the sixth century, which attributes it to Ting Huan (*c.* A.D. 180); "a perfume burner for use among cushions. . ., a contrivance of rings which could revolve in all the four directions (i.e., the three directions of space), so that the body of the burner remained constantly level and could be placed among bedclothes and cushions."

In this connexion we may mention a piece of charlatanry which shows an odd element of prophetic divination: about 320 A.D. Ko Hung speaks of a flying machine on the principle of the helicopter: "Some have made flying cars *(fei-ch'ê)* with wood from the inner part of the jujube tree, using ox leather straps fastened to returning blades, so as to set the machine in motion." More solid than these dreams was the fact that an old Chinese toy, the kite,

Perched on scaffolding, workers in a salt mine are busy removing the brine. This impression of a Han period engraving on brick depicts one of the many forms of mining in ancient China, ranging from minerals and precious stones to salt. In the 6th century B.C. the state sought a complete monopoly over mining.

Illustrations on these pages from "Dictionnaire archeologique des techniques", Editions de l'Accueil, Paris, 1963.

FARMING 2000 YEARS AGO. Three impressions made from stone engravings depicting scenes from rural life and labour during China's Han Period, when farming techniques became finally established. Above, ploughman at work with an ox. Above right, kitchen chores. Beneath food hung from the ceiling, housewives prepare a fish and watch over the cooking pot. Right, peasant farmers harvesting and threshing.

arrived in Europe at the end of the sixteenth century and became the ancestor of modern aviation.

Of simple machines in everyday use, we find that some of them were first manufactured in China. The folding umbrella is one of them, and Wang Mang caused several to be manufactured for magic purposes; some examples have been found in the Lo-lang tombs in northern Korea. The box-bellows (with double effect, like a double pump) was a most efficient instrument, still widely used.

A humble but very useful contrivance was the wheel-barrow; the Chinese one, with the wheel in the centre of the box, is much more practical than ours, because the man merely pulls it and holds it in equilibrium, but carries no part of its weight. It was first invented about 231 A.D. by Chu-ko Liang, for logistic purposes; it was called wooden ox *(mu-niu)*.

Cog-wheels are first mentioned in the Han period, and we possess a terracotta mould for a toothed bronze wheel of that epoch. They are the necessary prerequisites for the most typical Chinese hydraulic machine: the square-pallet chain-pump *(fan-ch'ê)*. It consists of an endless chain carrying a succession of pallets which, passing upward through a trough, draw up water. It may lift water up to 16 feet and can be worked by a treadmill, animal, or by a water-mill. . ., the invention is attributed to the engineeer Pi Lan, who died in 186 A.D. Water-mills, with both horizontal and vertical axes, are found in China. They first appear in the first century A.D., probably as an import from the West; oddly, they were chiefly employed for driving bellows, and seldom for grinding.

But engineering in China was fatally handicapped, in comparison with the West, by the lack of knowledge of some of the simple machines, such as the screw, and also of the crank (with the possible exception of the winnowing fan) and so it could never go farther than the so-called eotechnic stage.

Building enginering employed as its chief technique pisé and raw bricks in wall building. Baked bricks took their place during the Han period. The greatest and most famous feat of Chinese engineering is, of course, the Great Wall, which was formed in the years before 214 B.C. by connecting already existing stretches of wall. Its main purpose was administrative, fiscal, and, by making the passage of masses of nomad cavalry difficult, also military.

The Chinese road network was started by the first emperor Shih-huang-ti, who in 220 B.C. caused two great postal routes *(ch'ih-tao)* to be built, radiating from the capital Ch'ang-an towards Ch'i and Yen to the east, and towards the lower Huai to the south-east. They were planted with trees and were paved with a sort of macadam; no traces of them are left.

Several important roads were built under the Han dynasty. We may mention the one from Ch'ang-an to Szechwan; it was built, or at least broadened, about 120 B.C., and crossed a very rugged tract of country. About one-third of its 430 miles consisted of wooden trestles over mountain streams, or high up on the rocks. The general rule was that road building was the concern of the central government; in practice the latter took care only of those roads which were necessary for the transport of taxes in kind.

Suspension bridges are first mentioned in the famous text of the *Han-shu* concerning the "Hanging Passages" in the Hindu Kush. They are common in China, but it is impossible to settle their chronology. The greatest rope-bridge is that at An-lan in Szechwan: it has five spans, the greatest of which is 200 feet, the total being over 700 feet. Perhaps it was originally built by Li Ping in the third century B.C., but it is renewed every year.

The most notable innovation in Chinese agriculture of this period was the "alternance field" *(tai-t'ien)* technique, introduced by Chao Kuo in the middle of the first century A.D. It consisted in ploughing the furrow where in the previous year the balk had been, coupled with a careful weeding and lopping of the young plants. This procedure was tried first in the imperial domains, where it resulted in a double output per surface unit *(mou)*; and then it was officially introduced throughout the empire. It seems, however, that its use did not last for more than a couple of centuries *(Vol. II Pt. 3)*.

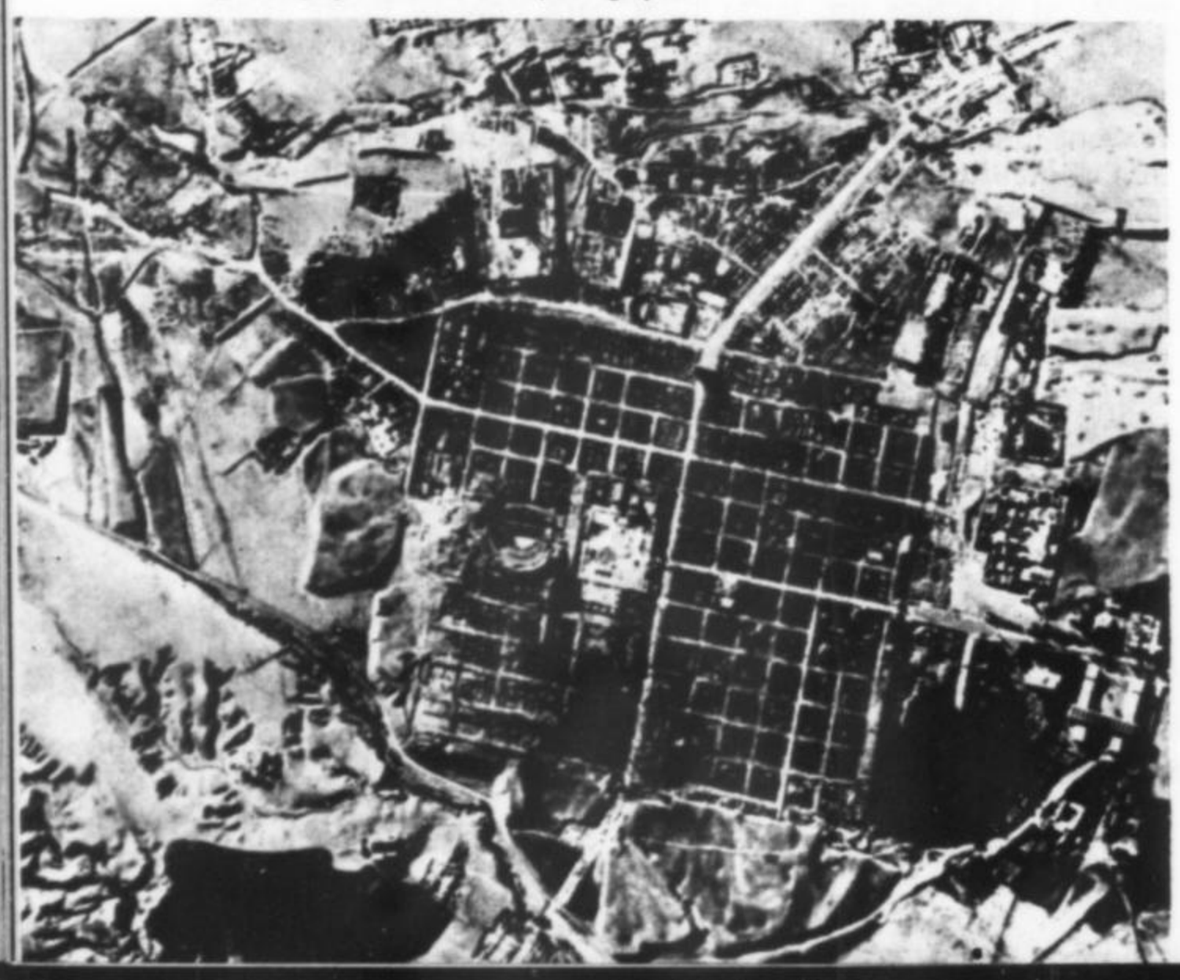
The birth of functional architecture

Town planning and housing in ancient Rome

by M. W. Frederiksen

Skilful architects and indefatigable builders, the Romans raised cities in every corner of their vast empire. Right, the noble ruins of Timgad, in Algeria. It was named Thamugadi when the legionaries of the emperor Trajan founded it in the Aures mountains in 100 A.D. Timgad conforms to the typical Roman town plan in which the forum or central square was placed at the intersection of two main streets (clearly visible in air photo below). As in Rome itself the cities of the outlying provinces had their public baths, theatres, arches of triumph and long arcades running alongside the streets. At Timgad many of the columns supporting these arcades still stand, as this photo shows.

© Compagnie aérienne de photographie



THE skill and understanding of the Romans, both in selecting sites and planning the towns, are shown most strikingly by their survival into modern times: in Italy, and the western provinces, where such policies were especially applied, many towns were created whose street-plans even today indicate their Roman origins. Like Juilius Caesar before them, the emperors accepted that municipalities were the basis of social life and administration, and so wherever conditions permitted they founded new colonies and towns.

The typical Roman town-plan was derived partly from earlier Greek traditions and partly from their own experience in laying out large military encampments. In its purest form, it was a strictly geometrical design, in which

© Ray-Delvert

two main streets intersected at right angles, and around these was laid out a network of lesser streets dividing the city into a series of uniform rectangular areas and building-blocks. It is seen most clearly where the builders were able to create a completely new city.

The town of Aosta (in northwest Italy) founded in 24 B.C. as the colony of Augusta Praetoria, was divided mathematically into sixteen rectangles, each of which was further divided into four; the surrounding town-walls took the form of a larger but similarly-proportioned rectangle.

In the Trajanic colony of Timgad in North Africa, one of the best preserved Roman towns, the same precision can be observed. But such perfection could not always be achieved; the plans are sometimes changed to meet the difficulties of a site or to include an earlier settlement.

Roman architects sought to avoid any appearance of monotony by adding secondary features; colonnaded streets, arches and gateways, or ornamental sculpture and fountains could help to soften the sense of geometrical rigour. But by such systematic planning they were able to provide the building and amenities that were, for the Romans, of the very essence of city life: the solemn central forum with its temples and public buildings for local magistrates and senate; an adequate drainage system and plentiful water-supply; public baths and theatres; and shops and open markets under official control.

Within a Roman town, private houses followed a variety of patterns. In Italy, where our information is fullest, the

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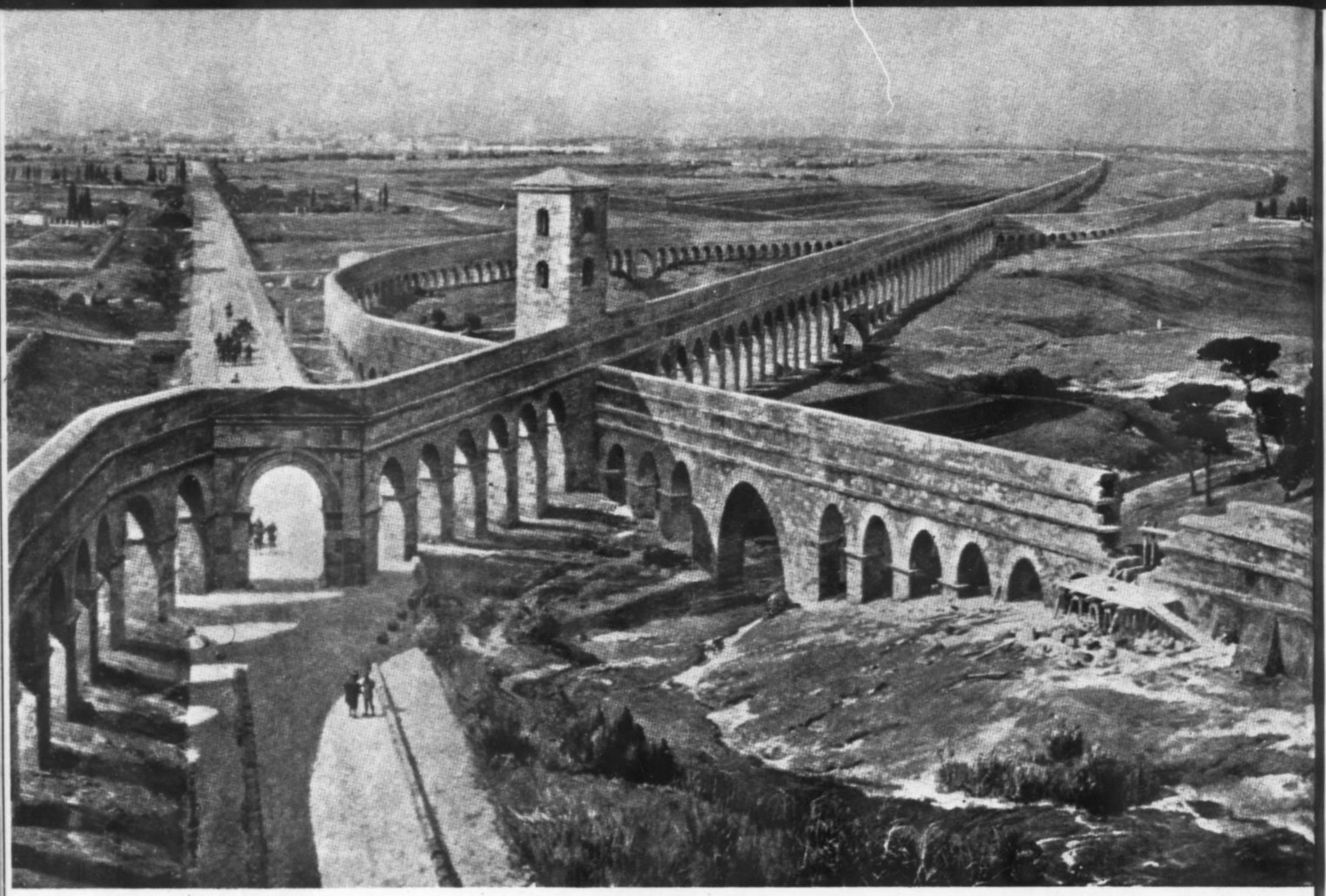


German Museum, Munich

OLD ROMAN AQUEDUCTS. A painting by Zeno Diemer showing the last remains of a huge network of water supply channels which ran for several hundred kilometres around Rome. The greatest of these aqueducts, which brought water from the hills around the city, was the Acqua Marcia, 55 miles (90 kms) long. At the fall of the Empire, Rome had nearly 1,000 public baths and 1,350 fountains, used one million cubic metres of water daily and, in the words of the poet Properce, "everywhere was heard the soft murmur of running water." Lead pipes and terracotta tubes were used to bring water supplies right into the houses of Roman citizens.

Five-storey housing development schemes

earliest houses are of a low-built, spreading form of one or two storeys, which were centred on an open hall (atrium) and a colonnaded garden (peristylium). These houses are best known from Pompeii, but they were fashionable also in Rome, and were of a style well suited to the aristocracy and municipal classes of the early empire. In the provinces, housing seems to have kept to local traditions, improved and embellished to suit the prosperity of the times.

It was not long before the increasing wealth and social changes in the empire were reflected in architecture. The richest classes began to build luxurious villas with surrounding gardens, often in the countryside or by the sea. But in the largest towns, where space was expensive and a large population of labourers and small craftsmen needed housing, there begins to appear the new style of building known as insulae, which were large apartment houses divided into many shops and small flats. Some areas of poor-class tenement housing in this style had existed in Rome from early times; but the new technique of brick-and-concrete architecture had made a revolutionary change, and after the great fire in 64 A.D. Nero took the opportunity to rebuild Rome systematically in the new style.

Of the many cities where these insulae were built, our best knowledge comes from the harbour town of Ostia. It is vividly clear how with new building methods spacious apartment houses of five storeys or more could be designed; the insula, which had previously been a ramshackle tenement in a slum, was now converted into a safe, pleasant, and almost fire-proof structure.

The historian Tacitus refers to the opponents of Nero's scheme, who defended the unsafe and often insanitary city quarters as they had been before and his comments have a certain ironical flavour to modern readers. This new utilitarian architecture reflected the changed social conditions; it supplied economical housing for a new population who found that only the cities supplied them with their employment and their amusements *(Vol. II Pt. 3)*.

M.W. FREDERIKSEN, of Worcester College, Oxford, is one of a number of scholars who contributed papers on specialized subjects to Volume II of the "History of Mankind."

(Cont'd from page 17)

BOMBAY INSTITUTE OF TECHNOLOGY

Unesco experts. Some of the Indian teachers were given Unesco fellowships to complete a three-year course in Soviet institutes and present their theses. They have now returned to India and are working as departmental and section chiefs at the institute. Other teachers have received study fellowships in Australia, the U.K. and U.S.A.

Today the students they have trained are going out to posts in India's developing industries. Many have already joined the staffs of steel-making plants like those at Bhilai, Durgapur and Rurkela, the machinery plant at Ranchi and the heavy electrical installation at Bopal, to name but a few.

There is also an urgent need to retrain men already working in industry. The institute has therefore been offering refresher courses to engineers and other technicians. In 1962-64 these courses included welding, metal cutting, machine tools, rolling, electronics and automation.

A new form of participation for the Unesco specialists are the annual diploma courses attended by engineers from different industries. These engineers spend a year studying their speciality, design projects for their diplomas and take examinations for a bachelor of technology degree.

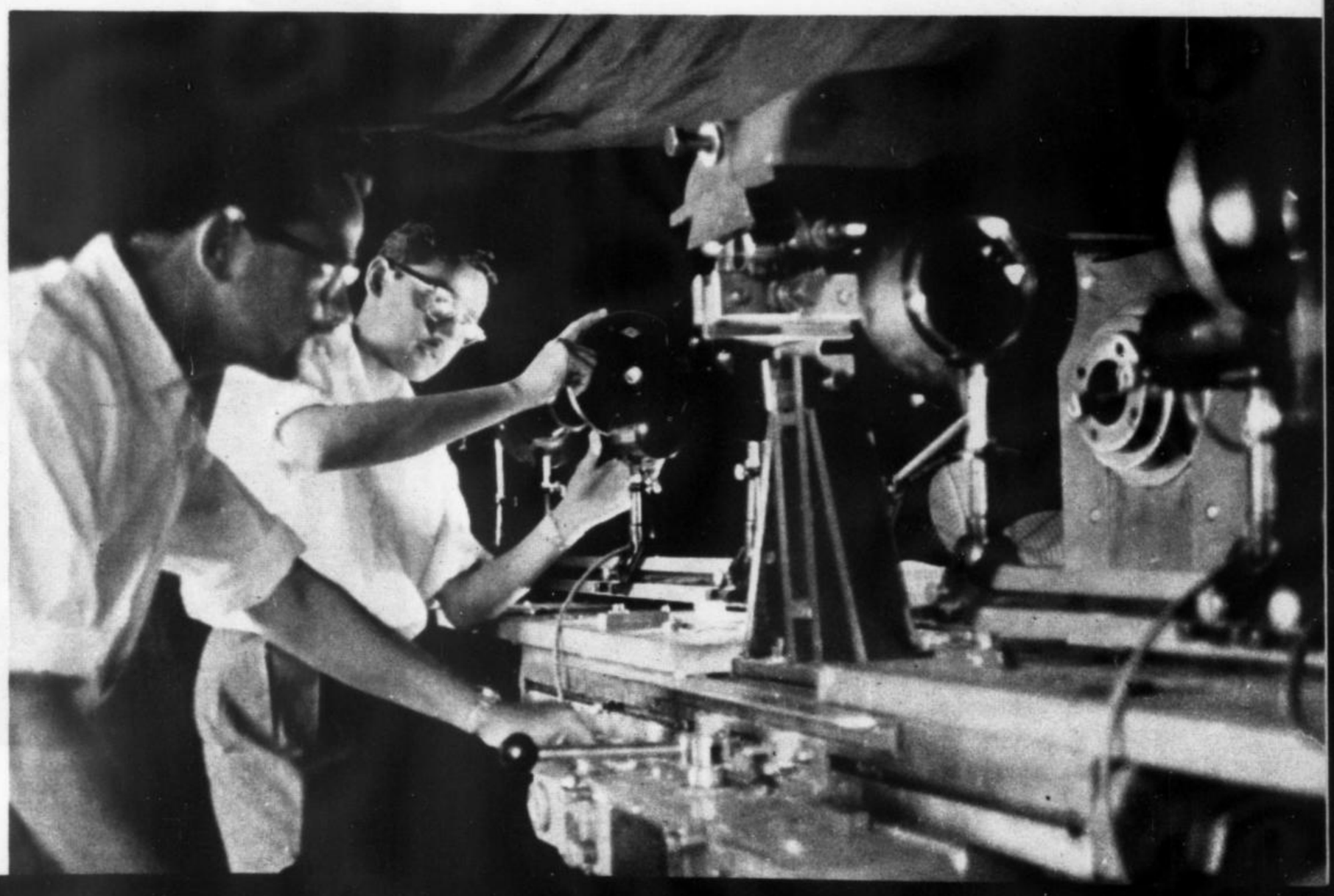
Unesco specialists also travel to other scientific and research institutes to lecture and deliver reports which all leads to shared experience between India's technical institutes. The Bombay Institute also co-operates closely with such major scientific centres as the Indian Institute of Science at Bangalore and the National Physics and Metallurgical laboratories at Delhi and Jamshedpur.

The Unesco and Indian specialists at the Bombay Technological Institute are working in a spirit of true co-operation. The daily discussions of curricula, lectures, teaching aids and curricular guides have convinced every Unesco expert completing his two or three-year stay at the Institute that his work will be ably carried on by other members of the faculty.

Now that the main laboratory equipment has been thoroughly tried and tested, the Institute has begun to concentrate on research facilities for its teachers. Young staff members are working on their theses for master of technology degree and many senior teachers are preparing their doctorates. Thanks to the Bombay institute they can now do so without having to go abroad. In 1964 over thirty members of the faculty were doing research and working for their doctor's theses. They received valuable assistance from Unesco specialists who consider this as one of their most rewarding duties. The series of textbooks and manuals written by members of the faculty and Unesco specialists now being published by the institute is in great demand in other technical colleges both in India and abroad.

The Bombay Technological Institute is becoming one of the great technological research centres of India and, in fact, of Asia as a whole. It plays host to All-India conferences, seminars and symposiums concerned with different branches of technology. The XVIIth Metallurgical Congress, held there in 1964, heard reports from fifteen teachers at the institute and from three Unesco specialists. Recently an All-India seminar aimed at improving co-operation between technical education institutes and industry was held. The institute receives many visitors—delegations and individual technicians—from countries in Asia, Africa and Europe.

VADIM A. JAVORONKOV *is a Soviet specialist in metallurgical technology. He was a member of Unesco's mission to the Bombay Technological Institute and taught there from 1961 to 1964. He is now a member of the staff of the Bauman Higher Technical Institute, Moscow.*



Specialized equipment is available on a large scale at the Bombay institute. Using these modern machines junior students learn the basics of metal technology and senior students become familiar with their chosen specialities. Right, milling machine fitted with a special device for studying the stress at the toolpoint.

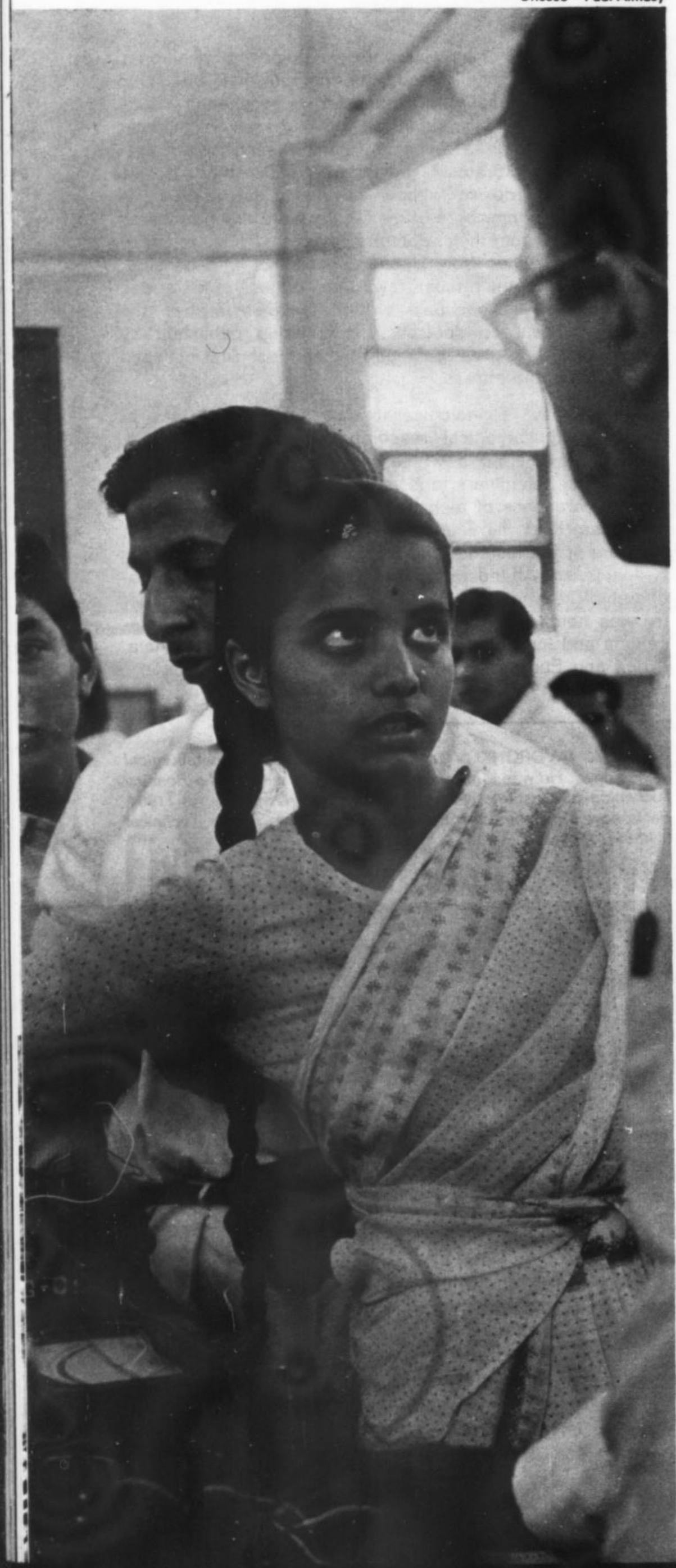
Unesco - Boucas

BOMBAY INSTITUTE OF TECHNOLOGY

This text originally appeared in the chapter, "The India of the Engineer" in the booklet "Web of Progress: Unesco at Work in Science and Technology", recently published by Unesco.

CONVERSATIONS O

Unesco - Paul Almasy

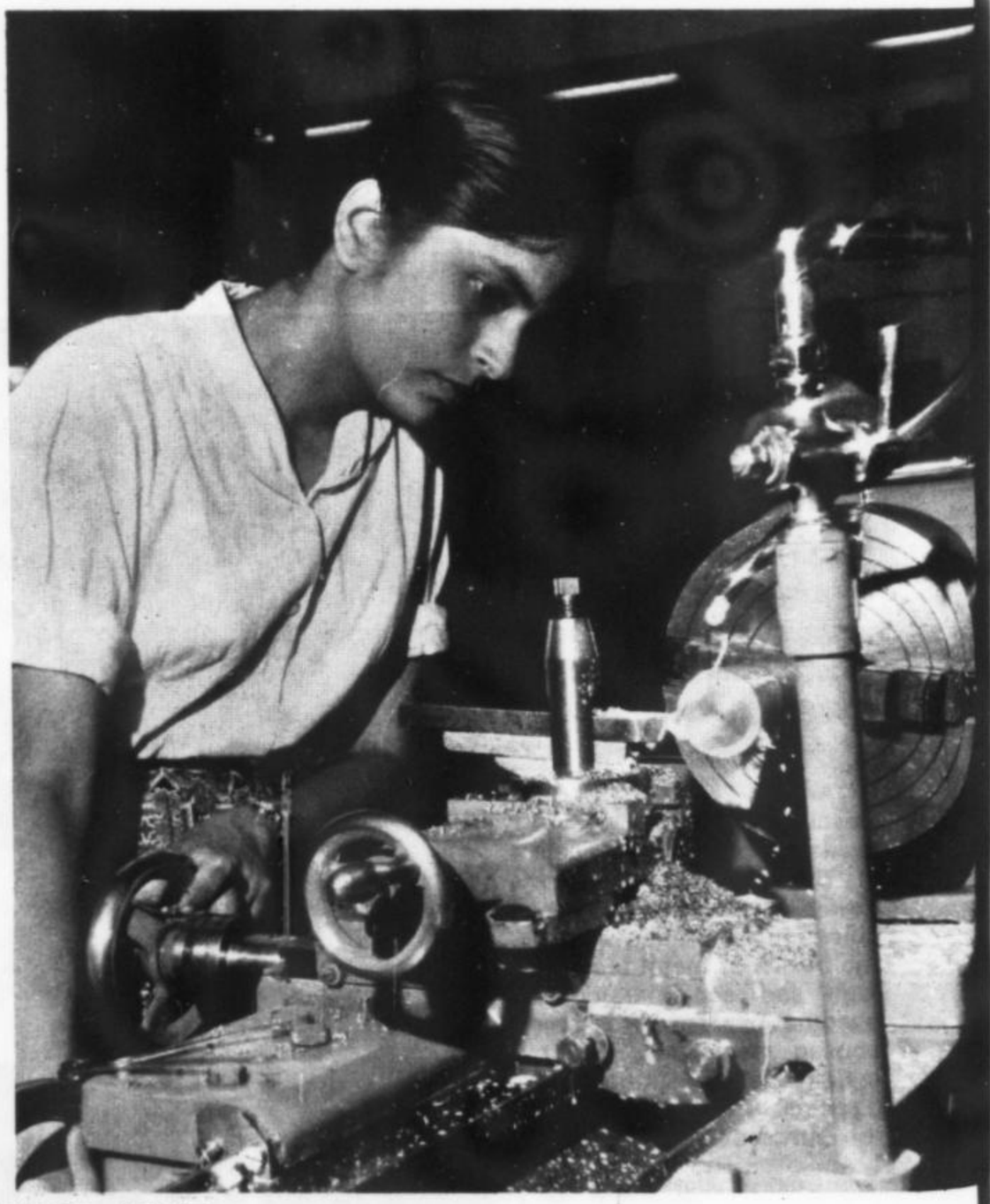


TALKING to some of the key men of the Bombay Technological Institute at Powai offers a fascinating insight into the technological awakening of India. They are all young—in their thirties or early forties—and virtually none of them come from families of engineers. They represent a startling change in the intellectual values of an entire society. Each of them has his own reasons for working at Powai.

Take Dr. Rudrapal Singh, the head of the institute's physics department. In his family, his is the first generation to go to a university. He worked through his master's degree at the University of Allahabad and then took his Ph.D. in theoretical physics at Washington State University in the United States. After doing research on solid state physics in Canada he returned to Allahabad but came to Powai in 1958 because of a "better scientific environment."

To a physicist, the presence of the Indian Atomic Energy Commission and the Tata Institute of Fundamental Research a few miles away is as important as the presence of Bombay's industries to the engineer. Dr. Singh was also drawn to the institute because it enabled him to carry

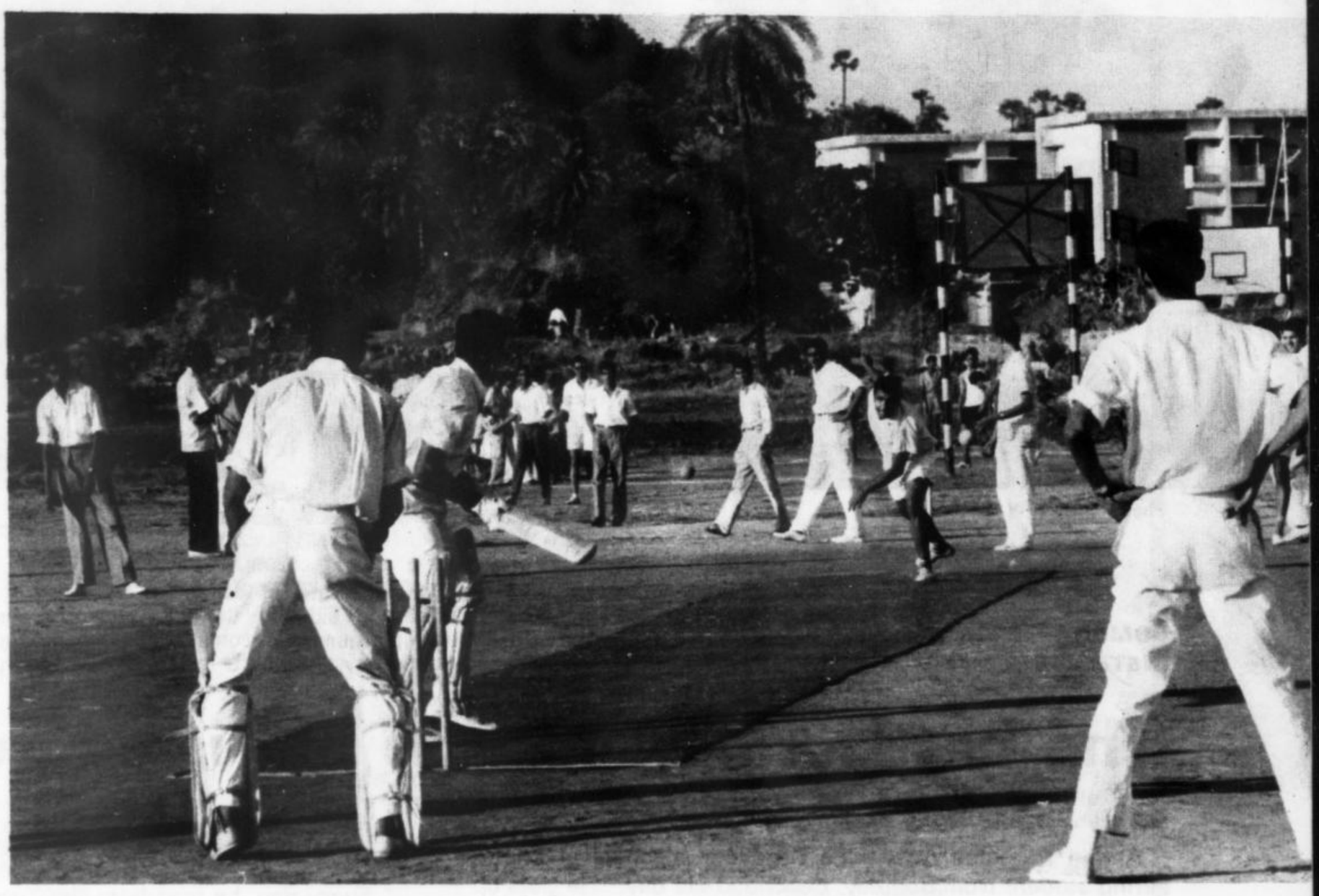
A woman assistant in the physics laboratory of the Bombay Institute of technology explains the operation of electrical apparatus to students. Below, practical workshop experience for Miss Tejaswini Saraf, training to be a researcher in electronics. For two years she was the only woman student.



Unesco - Jack Ling

S ON AN INDIAN CAMPUS

by Daniel Behrman



Student hostels (upper right of photo) at the Bombay Institute are set around a vast sports field with a gymnasium and stands. Athletic events, volley-ball and hockey are among the most popular sports, Here, students play in a cricket match arranged by the institute sports club.

Unesco - Paul Almasy

out one of his most cherished ideas: the creation of "interaction between scientists and engineers." He had received offers to do research work in the United States but, he told me: "Here, you are building. You may be doing less work yourself, but the future generations you train will do it."

I heard the same remark in another context from Professor J. T. Panikar, a civil engineer from Quilon in South India. "I am not building big dams myself," he told me, "but some of my students will." Professor Panikar earned his bachelor's degree in engineering from the University of Trivandrum and then worked as a civil engineer for the Kerala Electricity Commission. But he was looking for a challenge and, in 1953, he won a French Government fellowship to study construction techniques at the Ecole Nationale Supérieure in Toulouse. There he turned to fluid mechanics. He won his doctor's degree at Toulouse, came to the Bombay institute in its earliest days and worked on the construction of its buildings.

Dr. Rangiah Bedford came from Madras State. After earning his degree in electrical engineering from Guindy College of Engineering in Madras, he taught at the University of Illinois as a visiting assistant professor, but he returned to India because of an opportunity to help set up the electrical engineering department of the Bombay Institute of Technology.

Another electrical engineer, Mr. Boddapati Ravindranath, did his undergraduate work at Hindu University in Benares but came to the Powai Institute because he sought scope for research and a possibility for study abroad. The possibility materialized in September 1960, when he was given a Unesco fellowship to study electrical power systems at the Moscow Power Institute, returning to Powai in early 1963. He adapted himself quickly to the Russian language and also adapted himself to the Russian system of oral examinations which has been carried over to some extent in Powai.

France, the United States, the U.S.S.R., England . . . all the rivers of technology flow into Powai. Professor Cadambi Balakrishnan teaches a course in electrical engineering materials using Russian and Indian equipment and a textbook from the University of Minnesota.

One of the youngest of the top men at Powai is Dr. K. C. Mukherji who, at thirty-three, is the professor in charge of electrical engineering. After completing his undergraduate work he joined the Damodar Valley Corporation—the Indian counterpart of America's Tennessee Valley Authority—as an assistant engineer, but he won a scholarship to England where he worked first in industry and then earned his Ph.D. in 1956 at the University of London. He, too, was a research engineer for a large British firm but he returned home in 1958 to join the Bombay Institute of Technology because he felt it was a creative job.

Only ten years ago, Dr. Mukherji likes to remind you, a graduate of an Indian engineering college could hope to go into industry only as an unpaid apprentice engineer. Today, the shoe is on the other foot. Representatives of industry, both public and private, interview likely candidates on campus before graduation. The students at Powai are very much in demand and they know it.

CONT'D ON NEXT PAGE

Photos Unesco-W. Hubbell

BOMBAY INSTITUTE *(Cont'd)*

Since 1951 India has created five regional institutes of technology. The first of these, covering eastern India. was opened at Kharagpur near Calcutta with aid from the U.S.A. and U.K. and U.N.-Unesco technical aid, Engineers sent by Unesco helped to set up a number of courses, including production technology. Left, learning to use equipment in the geology laboratory. Right, the main entrance and institute buildings at Kharagpur.

The best form of foreign aid is education

Arvind Paranjpe, who is a fifth-year mechanical engineering student from Bombay, described his day. He gets up at 7, has his breakfast at 7.30 and then goes to lectures from 8.30 to 11.30. After a break for lunch until 1, he has tutorials from 1 to 2 and then laboratory work from 2 to 5. There is another break for tea and games until dinner at 7.30. He averages two hours of work at night. He would like to try for a fellowship for study in the United States and then come back to work in industry. "I must come back," he said. "We must depend more on ourselves. We can't go on having foreign help and experts all the time."

Mr. Paranjpe had studied science for two years at another school where students always resorted to "guidebooks" before taking an exam. He found that the competitive entrance exam for the Indian Institute of Technology did not fit any of the guidebooks. "They were more interested in fundamentals rather than how much you had been able to memorize," he said.

Research in electronics is the goal of Miss Tejaswini Saraf, a third year student from Bombay, now one of a number of women studying at Powai—after having spent two years there as the only one. She explained to me that she had found an early vocation for engineering when she started to tinker with the radio set in her home. Her first week as the only girl in Powai was "awkward" but she encountered no problems at all . . . not even in shop courses where she did blacksmith work, welding and fitting alongside the boys.

Research also looms far above anything else in the life of S. Ramani, a post-graduate student from Madras who came to Powai because it was the only institute in India offering a course in computer technology. He told me: "Research appeals to me. I don't want to do work that is meaningless. I don't want to be a slave to a machine. With an engineering degree here, I will have no financial problems. I've never been used to much money; that doesn't bother me."

Every day, he travels to the Tata Institute of Fundamental Research to work on the computer there, taking three buses in a two hour trip each way. He spends his weekends in the institute's library on the campus. "Three years ago," he said, "I didn't imagine that I would get this opportunity. There were 200 candidates for 20 seats in post-graduate electrical engineering . . . and only four seats in computer technology."

The director of the Bombay Institute of Technology, Brigadier S.K. Bose, has himself become, in a way, an end-product of the institute, for he was sent to Nigeria on a one month mission by Unesco to serve as consultant for the establishment of an engineering college there with the aid of the United Nations Special Fund.

Brigadier Bose is ubiquitous on the campus in his ancient sedan. He teaches a class in highway engineering so as not to lose touch with students. Under the institute's tutorial system, each staff member is responsible for five or six students and these tutors meet regularly with the director to discuss student problems. The creation of an *esprit de corps* in this brand-new school is one of these problems and Brigadier Bose has even found time to select the institute's song based on a poem by Tagore.

He lives for the future. Eventually, he foresees a student body of 6,000 at Powai, and its buildings have been carefully sited to allow room for growth.

"The best form of foreign aid is education," he told me, "but it is a long-term affair and you can see the results only after a generation. Foreign aid should come from a number of origins. Here, for example, you cannot simply transplant the Ecole Polytechnique or the Massachusetts Institute of Technology. We can expedite, but we cannot squeeze in too much. An evolution of a hundred years cannot be carried out in five . . . but perhaps in twenty-five."

Letters to the Editor

WORLD-WIDE VOLUNTARY SERVICE

Sir,

International Voluntary Service is part of a world-wide organization which attempts to relieve poverty, suffering and hostility among people through the service of its volunteers. Our work projects range from spending a day painting rooms in a centre for Chicago slum children to working for years on community development in India.

During the summer we hold many work projects in the U.S. and Europe. This year there will be over 100 camps in Europe and about 10 here. We will work with deprived children in Chicago, rebuild a burned-out camp in Tennessee, construct needed facilities in a poverty-stricken town in Florida, etc. Our volunteers will come from all over the world and will be of different backgrounds and ages (though most tend to be in their 20's, we are hoping to raise the average age of our volunteers).

We strive to have represented in our camps as many diverse points of view as possible. We would welcome inquiries from your readers.

Joyce Klein, US-IVS
American Group of
Service Civil International
1116 E. 54th Place, Chicago
Illinois 60615, U.S.A.

POMPEII IN PERIL

Sir,

Last October when I returned to Pompeii, which I had visited two years previously, I became aware of a general deterioration and had difficulty in gaining access to the houses: watchmen were so few and when they could be found, were unco-operative, disinterested and occasionally surly; sometimes too, when the gate to a house was unlocked, access was virtually impossible on account of the uncontrolled growth of weeds and brambles—in many cases, these were breaking through mosaic designs and disrupting mosaic floors. The sense of neglect was appalling and, alas, real.

An intelligent and, to his credit, greatly concerned watchman, pointed out recent vandalism: visitors' (and workmen's) graffiti and other damage to wall-paintings; I learned that the number of watchmen had been reduced and the financial position had led to increasing economies in maintenance.

But, Pompeii, like Herculaneum which seems still well-cared for, is a unique, precious and priceless archaeological treasure of the utmost value to the whole world, whose peoples indeed come to visit it, not only in the persons of their most eminent archaeologists, but in their hundreds of thousands each year as tourists. It is not just a tourist attraction however, though indeed it is that in every sense, but an unparalleled glimpse into a pagan world, stilled, in an instant of time and now miraculously revealed before our eyes by its painstaking recovery by the most careful and diligent excavation over many years. And, in this connexion, it would be forever regrettable if any present-day religious prejudice were to endanger the preservation, by apparent neglect, of those pagan vestiges, now deemed obscene, as seems to be in danger of happening in the case of the Lupanar and elsewhere in Pompeii.

The preservation and maintenance of so internationally important an archaeological treasure should not be the burden of the Government of Italy alone and, in view of the splendid work you have initiated in saving Abu Simbel, I hope that, through Unesco, some steps may be taken towards international concern in this urgent matter, before it becomes too late.

Dr. Norman Chisholm
London, England

FOLK MUSIC ON RECORDS

Sir,

Some time ago "The Unesco Courier" published an article by Alain Daniélou (A New Language for Western Ears; June 1962) announcing the release of a series of folkmusic recordings. Being very interested in other cultures, especially the musical ones, I should like to know which records of this planned series are now on sale.

T. de Boer
Nijmegen, Netherlands

Ed. note: Long-playing 12-inch records already published in the Unesco Collection, "An Anthology of the Music of the Orient", édited by the International Music Council under the direction of Alain Daniélou, present the music of Laos (BM 30 L 2001); Cambodia (BM 30 L 2002); Afghanistan (BM 30 L 2003); Iran I (BM 30 L 2004); Iran II (BM 30 L 2005); India I (BM 30 L 2006); India II (BM 30 L 2007) and Tunisia (BM 30 L 2008). Records of Tibetan and Japanese music are due to appear shortly. Records in this series may be ordered through record dealers or direct from the publisher: Bärenreiter Musicaphon, Heinrich Schutz Allee 35, Kassel, Federal Republic of Germany; price per record: equivalent of DM 25 (about $ 6.00 or 30 F frs.). A series of folk music recordings is being prepared by the International Folk Music Council under the auspices of the International Music Council. The first records, also published by Bärenreiter Musicaphon, should be available early next year. PLEASE DO NOT SEND ORDERS TO UNESCO.

COURIER IN THE CLASSROOM

Sir,

In our higher English classes we sometimes discuss your articles. They are "eye-openers", besides being extra good English exercises. I personally like the readers' letter corner, where all kinds of viewpoints are expressed—sometimes the most unexpected. We are all very pleased with your review.

Brother Nicolas
Institution Saint-Joseph
Thonon-les-Bains, France

INTERNATIONAL CONSERVATION CORPS

Sir,

I am always pleased to see articles on the conservation of wildlife and natural resources published in "The Unesco Courier" and I was certainly impressed by Professor Bourliere's "Sanctuaries Astride Frontiers" (Feb. 1965).

The idea that national parks and other conservation areas could become meeting points for young people from different nations has prompted me to write to you about efforts being made in this field by the International Youth Federation for the Study and Conservation of Nature.

For the past ten years this organization, which is run entirely by young people in Europe, has arranged many international camps for the study of nature, and courses for demonstrating the principles of nature conservation and landscape management. Many of these camps have taken place in national parks such as Gran Paradiso and Lüneburger Heide, and their success has given rise to the formation of an "International Register" of young people who wish to take part in such projects.

It is hoped that as the Register develops it will prove possible to form an International Conservation Corps which will provide opportunities for its members to understand, through work and study projects, the special values of nature conservation for man's future wellbeing. A national Conservation Corps has been working successfully in Britain for some time now and so an international extension of the idea should prove its value.

It is a good thing that young people from different nations should be able to meet on a basis of common interest and how much better it is that they can meet in unspoiled areas set aside by agreement between nations.

D.S. Davis
London, England

Ed. note: Several projects of the International Youth Federation for the Study and Conservation of Nature have received Unesco aid.

From the Unesco Newsroom...

NETHERLANDS UNESCO CENTRE: Nucleus of a network of over 100 local Unesco committees in the Netherlands, the Unesco Centre in Amsterdam has celebrated its 15th anniversary. Founded by student volunteers, it was the forerunner of a wave of volunteer movements on behalf of Unesco around the world which has led to the formation of Unesco Clubs and similar organizations in many member states.

ATOMIC POWER ON WHEELS: A mobile atomic power station is now operating in the Soviet Union. Weighing 350 tons and mounted on four cross-country vehicles, it uses only 14 grammes of nuclear fuel a day. Power plants of this type will be used in the north and east of the Soviet Union in areas where there are no sources of power and fuel is in short supply.

NATURE CONSERVATION IN ETHIOPIA: A Unesco mission has recently been helping Ethiopia to plan a campaign for the conservation of nature and natural resources. Two Unesco specialists have been advising the government on setting up a conservation board and bureau and on emergency measures to protect threatened species and sites. Another member of the mission has been helping to introduce the subject of conservation into school programmes.

SOCIAL SCIENCES' DICTIONARY: In a "Dictionary of the Social Sciences" (1) recently published under Unesco auspices, terms and concepts of basic importance in the social sciences are defined and described by 275 British and American specialists. The 750-page English language volume is part of a Unesco project for the clarification of social science terminology in some major languages (English, French, Spanish and Arabic at present). Other language editions will follow the English.

(1) Tavistock Publications, 11 New Fetter Lane, London. Price in U.K. : 6 1/2 guineas.

U.S. HIGHER EDUCATION: College and university enrolment in the United States this year has soared to more than five million, reports the U.S. Office of Education. Total degree-credit enrolments have broken all records for the 13th consecutive year and are more than double compared with ten years ago.

FOR ELUSIVE AURORAS: Scientists aboard the Australian National Antarctic Research vessel, "Nella Dan" have been using a special camera to make films of auroras so faint that they can hardly be seen by the human eye. The camera is fitted with an image intensifier which can multiply 100,000 times the effect on film of light given off by the aurora.

SPACE AGE DICTIONARY: An Astronautical Multilingual Dictionary prepared by the International Academy of Astronautics is due to be published later this year. It will have a basic list in English of about 5,000 terms used in astronautics, with equivalents in French, German, Italian, Russian, Spanish and Czech, and separate alphabetical lists of the translations in each language. Further information can be obtained from the International Astronautical Federation, 250, rue Saint-Jacques, Paris 5, France.

PACKAGED GARDENS: Distributions of "packaged" gardens have been made in 10 Indian states under a nutrition programme being carried out by the Government of India with the help of FAO and UNICEF. These packages of certified seeds provide a combination of vegetables for school gardens, community gardens and home-kitchen gardens.

INTERNATIONAL RESEARCH FLEET: Thirty-three research vessels from seven countries will embark on a new venture in co-operative oceanographic research in July when they begin studying the Kuroshio Current (its Japanese name means "black current") in the northwest Pacific. The Kuroshio Current, the Pacific's equivalent of the Gulf Stream in the Atlantic, is believed to influence both fishing and weather in the Far East.

TEACHING TEACHERS BY POST: A Unesco specialist in organizing correspondence courses is now helping to train teachers in the Unesco-UNRWA schools for 200,000 Palestine refugees children in Jordan, Lebanon, Syria and the Gaza Strip territory of the U.A.R. About 90%—some 4,000—of these elementary and preparatory school teachers need extra training, but cannot be withdrawn from the schools. The only solution is an in-service training programme in which correspondence courses play an important part.

INTERNATIONAL BIBLIOGRAPHIES
We are pleased to bring Maxwell's International Subject Bibliographies to the attention of readers to whom they are available free of charge on request. Each of these specialized bibliographies gives a select international listing of the most significant literature in a given field published throughout the world, and thus covers many languages. Subjects dealt with which may be of special interest to readers include: Series I, electronics; 2, oceanography; 3, archaeology; 4, design and construction of scientific laboratories; 5, dermatology, venereology and physiology of the skin; 6, orthopaedics; 10, electrochemistry; 15, graphic arts and industries; 19, reinforced plastics; 24, ultrasonics; 25, cartography; 34, phytopathology. A complete list of all bibliographies currently available or in production is available. Requests for bibliographies should be sent to either of the joint publishers: The Documentation and Supply Centre of Robert Maxwell & Co., Ltd., Waynflete Building, St. Clement's, Oxford, (U.K.); The Documentation and Procurement Centre, Division of Maxwell Scientific International Inc., 44-01, 21st St., Long Island City (U.S.A.). Readers are asked to mention this announcement, when ordering.

PARTNERSHIP OF OVER 100 COUNTRIES

The work of the United Nations Special Fund has been honoured by a U.N. commemorative stamp. Inaugurated in 1959, the Special Fund is the U.N.'s largest programme of technical co-operation for economic growth and social advancement in the developing countries. It is a partnership not only between more than 100 countries, but also between the U.N. and nine of its specialized agencies. Another recently issued U.N. stamp commemorates the U.N. Peace-keeping Force in Cyprus. As agent in France of the U.N. Postal Administration, Unesco's Philatelic Service stocks all U.N. stamps and first day covers currently on sale. For further details write to The Unesco Philatelic Service, place de Fontenoy, Paris (7e).

Flashes...

■ *Over 800 million people have now been freed from the threat of malaria thanks to the world malaria eradication campaign, reports WHO. This figure represents 52 % of the population living in the originally malarious areas.*

■ *Unesco now has 119 member states. The latest countries to join are Malta (118th member state) and Portugal (119th).*

■ *Under the World Food Programme, FAO is carrying out a $1.13 million emergency relief programme for 700,000 drought-stricken farmers in Somalia. Somalia's crops have been near-failures for the past two years.*

■ *The world fish catch in 1963 was 46.4 million metric tons, a 2.4% increase over 1962, reports FAO. Top fishing nation was Peru with 6.9 million tons.*

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